

2019

SINGLE-FAMILY  
BUILDING  
ASSESSMENT

RESIDENTIAL BUILDING  
STOCK ASSESSMENT

**2019 SINGLE-FAMILY BUILDING ASSESSMENT**  
**RESIDENTIAL BUILDING STOCK ASSESSMENT**

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# Letter from NYSERDA

## Senior Vice President

NYSERDA is pleased to present this Residential Building Stock Assessment, an update to the Residential Statewide Baseline Study released in July 2015. This update provides insight into single-family home structures across the State, including energy use and energy efficiency. Detailed data collected and summarized through this study includes home size, systems used for heating and cooling, and other home features such as lighting, electronics, and appliances.

Under Governor Andrew M. Cuomo's leadership, New York State has enacted the historic Climate Leadership and Community Protection Act (CLCPA), which promotes energy efficiency and includes nation-leading targets to reduce greenhouse gas emissions and put New York on a path toward achieving a carbon-free electricity system by 2040.

The snapshot created by this report puts the CLCPA into perspective by helping us recognize the current status of our single-family housing stock and the progress we've made in energy efficiency as well as how far we still need to go to achieve a carbon-neutral building stock by mid century.

This report is designed to provide you, as an industry stakeholder, with data to inform your work. The information here is also available online on OpenNY at [data.ny.gov](http://data.ny.gov) and at [nyserdera.ny.gov](http://nyserdera.ny.gov).

I encourage you to continue to help us move toward New York State's clean energy future and take advantage of these tremendous resources.

Sincerely,



Janet Josept  
Senior Vice President, NYSERDA



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Cadmus would also like to thank the project team at Honeywell, which provided crucial recruiting and field staff capabilities, including project team lead Mike Lyons and field manager Nathan Yehle.

Finally, Cadmus expresses whole-hearted appreciation for the field staff who completed the 456 site visits during a two-month period. This report would not be possible without their contributions.

# ACRONYMS AND ABBREVIATIONS

<b>AC</b>	Air conditioning
<b>ACH50</b>	Air changes per hour at 50 Pascals
<b>BPI</b>	Building Performance Institute
<b>CCFL</b>	Cold cathode fluorescent light
<b>CEER</b>	Combined Energy Efficiency Ratio
<b>CFL</b>	Compact fluorescent light
<b>CFM50</b>	Cubic feet per minute at 50 Pascals
<b>CRT</b>	Cathode ray tube
<b>DVD</b>	Digital Versatile Disc
<b>EDR</b>	Economic Development Region
<b>EER</b>	Energy Efficiency Ratio
<b>EF</b>	Energy Factor
<b>HERS</b>	Home Energy Rating System
<b>HSPF</b>	Heating Seasonal Performance Factor
<b>HVAC</b>	Heating, ventilation, and air conditioning
<b>LCD</b>	Liquid crystal display
<b>LED</b>	Light emitting diode
<b>NYSERDA</b>	New York State Energy Research and Development Authority
<b>OLED</b>	Organic LED
<b>PSD</b>	Performance Systems Development
<b>RBSA</b>	Residential Building Stock Assessment
<b>RESNET</b>	Residential Energy Services Network
<b>RSBS</b>	Residential Statewide Baseline Study
<b>SEER</b>	Seasonal Energy Efficiency Ratio

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# EXECUTIVE SUMMARY

## KEY FINDINGS

The NYSERDA 2019 *Residential Building Stock Assessment* (RBSA) provides the first update to the 2015 *Residential Statewide Baseline Study* (RSBS) of New York State, to characterize the estimated 5.3 million single-family homes throughout the State. Like the 2015 RSBS, the RBSA collected data about New York homes through two primary means—web and telephone surveys and site visits.

This report presents a high-level overview of findings from the surveys and site visits conducted for the 2019 RBSA. Appendix A provides more-detailed results across all collected home characteristics in roughly 250 tables. A total of 2,419 participants completed the web and telephone survey statewide. Under the leadership of Cadmus as prime contractor, field staff working with subcontractors PSD and Honeywell completed site visits at 456 single-family homes, which comprised new and existing homes sampled within each of the State's 10 Economic Development Regions (EDRs).

The project also encompassed two additional components—an HVAC market assessment to inform updating baseline conditions for high-efficiency heating equipment in the State, and a potential study, which estimated three-, five-, and 10-year energy efficiency potential in the State. Documenting the results of these two additional components falls outside of the scope of this report, which presents findings solely for the building assessment component. Separate reports are available for the HVAC market assessment and potential study components.

The primary objectives of the RBSA are to provide a profile of new and existing homes in the State based on data from a representative sample of homes and to determine changes in building and equipment stock since the 2015 RSBS, including changes in the saturation of energy-consuming equipment

(electric, natural gas, and other fuels), building characteristics, and energy management practices. The RBSA also collected customer household and demographic information.

Information provided by this study will be used by NYSERDA, the New York State Department of Public Service, energy efficiency program administrators throughout the State, and other interested parties for a variety of purposes, such as informing program planning and setting baselines for savings calculations. This information also provided necessary inputs to the HVAC market assessment and potential study components of the study.

The following section highlights several key findings from the NYSERDA RBSA study. Some of these findings represent select statistically significant differences relative to the 2015 RSBS; other findings stand out as notable because of other considerations, such as indicating significant potential for savings. All results are weighted to provide estimates representative of single-family homes throughout the State. This study defines single-family homes as any house or living unit in a building with one to four living units. Many tables present findings by Climate Zones 4, 5, and 6, as defined in the 2015 International Energy Conservation Code. The study presents some findings by existing and new homes, with new homes defined as single-family homes constructed in 2015 or after. Throughout this report, findings not indicated as being specific either to existing homes or new homes apply to the total population of single-family homes within a given geographic area. Except where presented by climate zone, findings apply to the statewide population of single-family homes.

More Homes Use Air Conditioning

90% of homes statewide use air conditioning (AC), up from 85% in the 2015 RSBS.

	Central AC	Room or Window AC	Heat Pump	No AC
2015 RSBS	35%	48%	2%	15%
2019 RBSA	45% <sup>▲</sup>	40% <sup>▼</sup>	5% <sup>▲</sup>	10% <sup>▼</sup>

SEE HEATING AND COOLING

Fewer Homes Primarily Heat with Fuel Oil

Primary heating with fuel oil dropped from 25% to 19% statewide.

	Climate Zone 4	Climate Zone 5	Climate Zone 6	Statewide
2015 RSBS	38%	13%	23%	25%
2019 RBSA	26% <sup>▼</sup>	10% <sup>▼</sup>	20%	19% <sup>▼</sup>

SEE HEATING AND COOLING

Natural Gas Gained Share

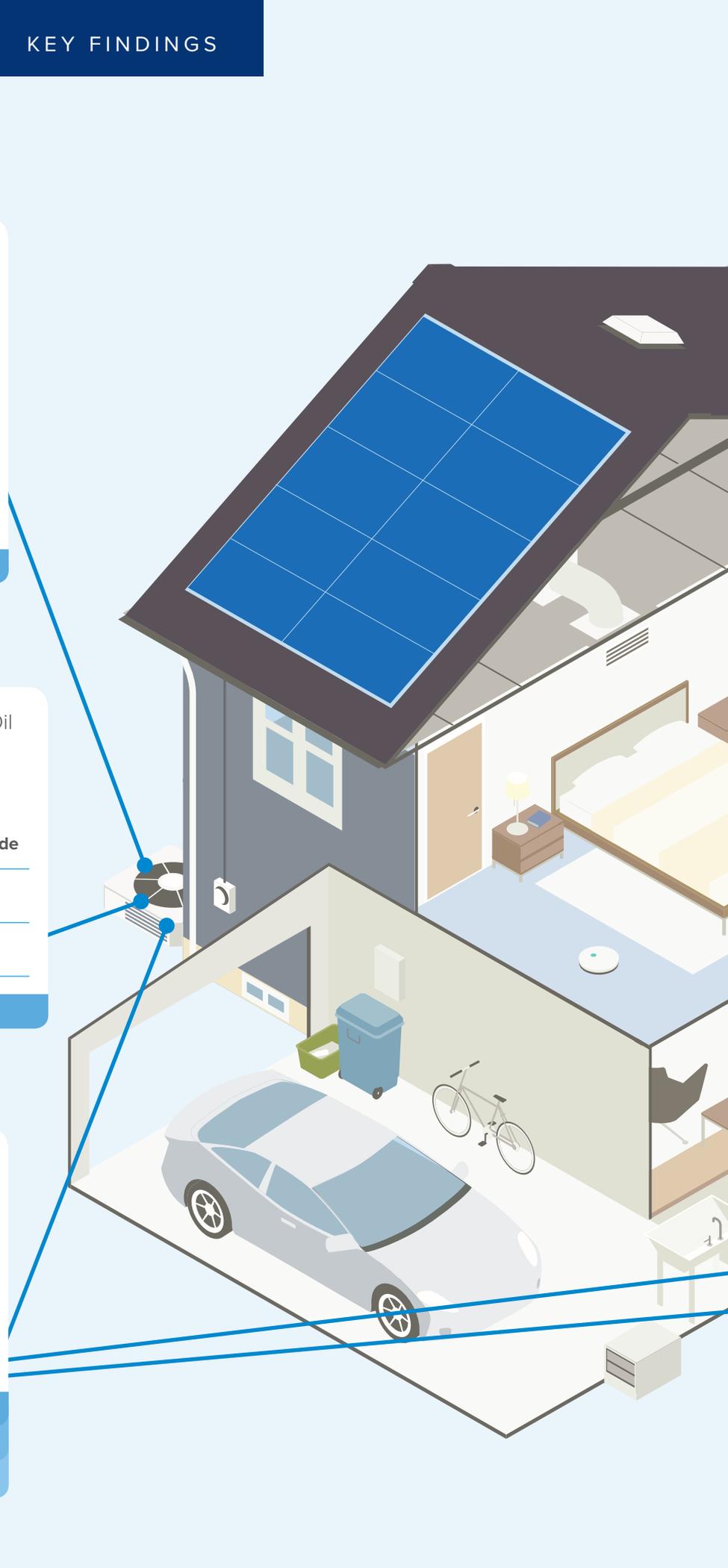
RBSA data show significant increases in natural gas across end uses.

	Primary Heating	Water Heating	Clothes Dryer
2015 RSBS	55%	54%	32%
2019 RBSA	65% <sup>▲</sup>	67% <sup>▲</sup>	43% <sup>▲</sup>

SEE HEATING AND COOLING

SEE WATER HEATING

SEE APPLIANCES





### Smart Thermostats Get Traction

11% of homes with central heating or cooling use a smart thermostat.

Thermostat Type	Statewide
Smart	11%
Manual	23%*
Programmable	66%

[SEE HEATING AND COOLING](#)

### Water Heater Efficiency Standards

Assuming same-size replacement, only 7% of water heaters statewide must achieve the highest energy efficiency ratings under federal standards.

Water Heater Size	Statewide
55 gallons or smaller	93%
More than 55 gallons	7%

[SEE WATER HEATING](#)

### Air Sealing Potential

Blower door testing shows room for improvement statewide in air leakage.

	Existing Homes	New Homes
Air changes per hour at 50 Pascals	12.1	4.0

SEE BUILDING SHELL

### Lighting Transformation Continues

LED bulbs now far outnumber CFLs, and inefficient bulbs have dramatically declined.

Inefficient	37%▼
LED	34%
CFL	18%
Linear Fluorescent	8%
Other	2%

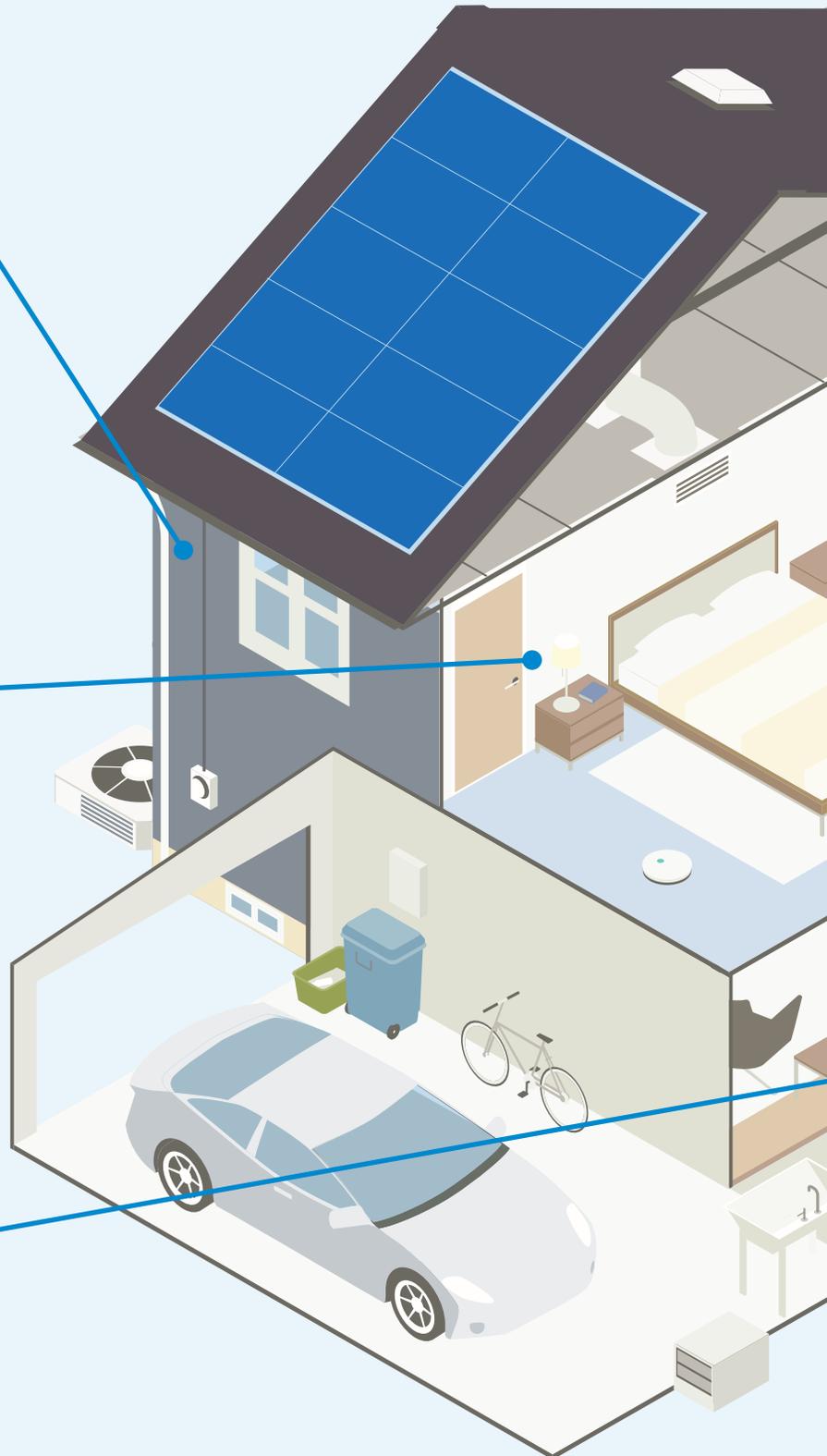
SEE LIGHTING

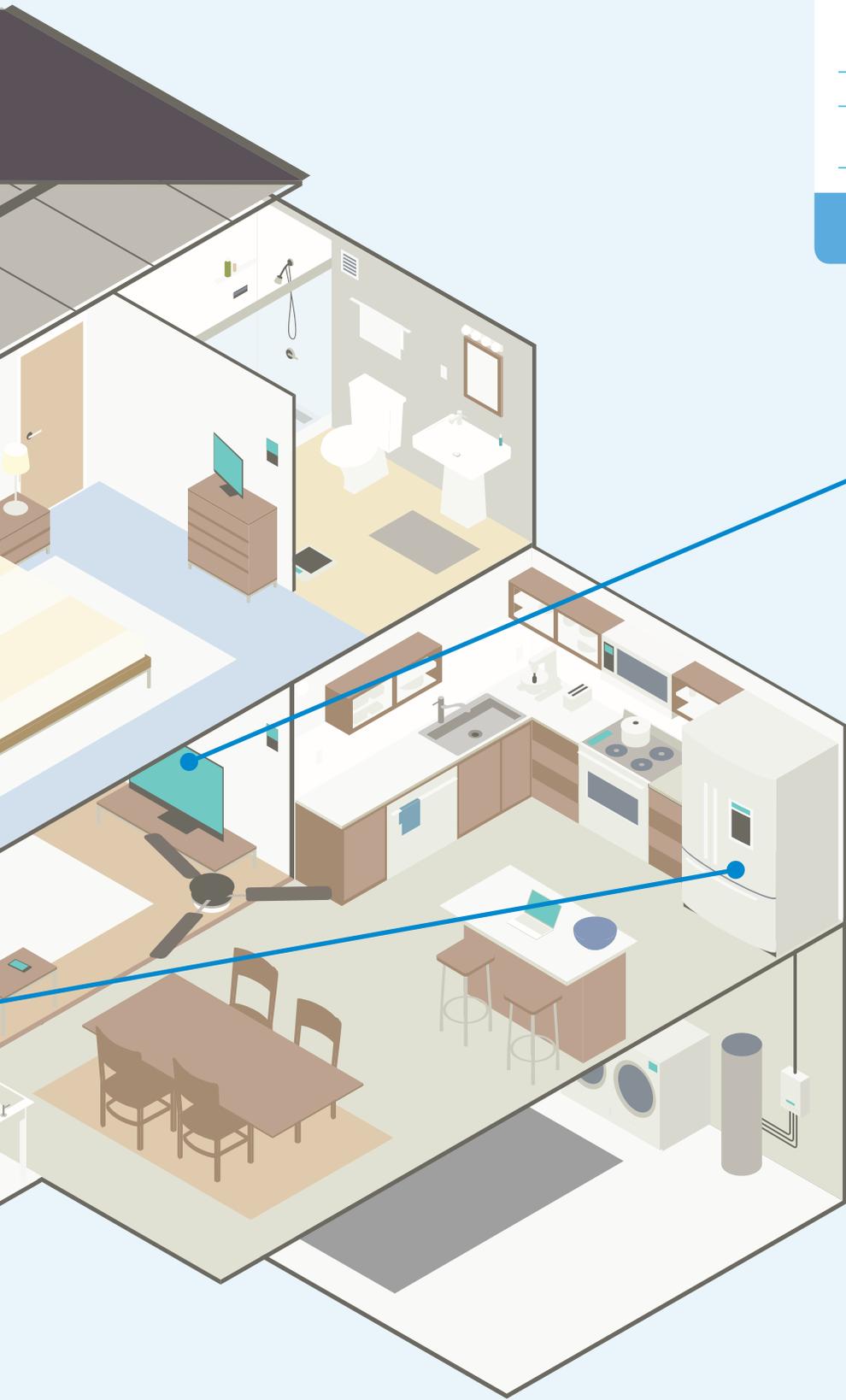
### Second Refrigerators are Common

One in four homes statewide has a second full-size refrigerator.

Number	Full-Size Refrigerators
1	71%
2	25%
3	3%

SEE APPLIANCES





### Program Awareness and Participation

Knowledge remains key. More than 50% of program nonparticipants said they did not know of any energy efficiency programs.

2015 RSBS	2019 RBSA	2015 RSBS	2019 RBSA
51%	53%	15%	30% <sup>▲</sup>
Am not aware of any		Do not know who to contact	

**SEE ENERGY EFFICIENCY PROGRAM AWARENESS AND PARTICIPATION**

### Mostly LED Televisions

LEDs make up more than half of all televisions, a significant increase from 2015.

Television Type	2015 RSBS	2019 RBSA
LED	35%	51% <sup>▲</sup>
LCD	35%	36%
CRT	26%	6% <sup>▼</sup>

**SEE ELECTRONICS**

# STUDY OVERVIEW

## ABOUT THIS REPORT

This report presents findings of the building assessment component of the 2019 RBSA, which consisted of web or telephone interviews with 2,419 respondents throughout the State and site visits to 456 single-family homes. While the body of this report focuses on the most notable or significant findings, Appendix A provides a lengthy collection of tables, including updated versions of nearly all tables provided in the 2015 RSBS. Appendix B provides a detailed record of the study methodology for readers who want more detail than provided in the following pages.

## GUIDING PRINCIPLES

As with the 2015 RSBS, providing results representative of homes throughout the State was a key priority. Retaining the ability to compare results against those of the 2015 RSBS was also essential. Finally, to provide results soon enough to inform NYSERDA's contributions to State policy processes, all data collection had to be complete in fall 2018, in less than four months after project kickoff. These requirements led to three decisions:

- The 2019 RBSA sampled by EDR to ensure that homes were sampled throughout the State and to provide stratified sampling similar to that of the 2015 RSBS.
- As with the 2015 RSBS, the RBSA also included separate stratified samples for new and existing homes across the 10 EDRs.

- The 2019 RBSA leveraged data collection methods and tools used in the 2015 RSBS as practical, though the team improved the tools to overcome some previous limitations and to adapt to current trends and priorities.
- The 2019 RBSA recruited participants primarily by mailing postcards to homes sampled from New York State Department of Taxation and Finance tax assessment rolls, instead of recruiting from a list of customers provided by investor-owned utilities (as with the 2015 RSBS).

## SAMPLE DESIGN

Cadmus developed a sampling plan with the goal of achieving 90% confidence and  $\pm 10\%$  precision for most parameters of interest at the State level and 90% confidence and  $\pm 20\%$  precision within each of the 10 EDRs, shown in Figure 1. Based on coefficients of variation for key metrics calculated from the 2015 RSBS data, Cadmus designed a nested approach that involved surveying approximately 2,400 households and visiting 486 homes to collect detailed information from 120 new homes and 366 existing homes.

**FIGURE 1. NEW YORK STATE ECONOMIC DEVELOPMENT REGIONS**



Table 1 illustrates the target site visit completions for each home vintage within each EDR.

**TABLE 1. TARGET SITE VISIT SAMPLE SIZES**

ECONOMIC DEVELOPMENT REGION	EXISTING HOMES	NEW HOMES	TOTAL
Capital District	32	16	48
Central New York	57	8	65
Finger Lakes	42	18	60
Long Island	30	10	40
Mid-Hudson	23	18	41
Mohawk Valley	26	5	31
New York City	60	13	73
North Country	20	13	33
Southern Tier	26	5	31
Western New York	50	14	64
<b>Total</b>	<b>366</b>	<b>120</b>	<b>486</b>

## SAMPLE FRAME

Unlike the 2015 RSBS, the 2019 RBSA did not use customer information provided by investor-owned utilities to recruit for the study, largely because the project timeline did not allow enough time to request

and receive customer information. Instead, Cadmus constructed the study sample frame by randomly selecting single-family homes from New York State Department of Taxation and Finance tax assessment rolls. Where necessary, such as for new homes (homes built in 2015 or later) in most areas, Cadmus purchased qualified mailing lists from a third party—Dynata (formerly Research Now SSI).

## RECRUITING

With the nested design employed by the RBSA (and the 2015 RSBS before it), the study first recruited participants to complete an extensive survey, which collected a variety of data essential to characterizing single-family homes, including the size and type of the home, characteristics of space and water heating equipment, information about major appliances, and data on many other end-use equipment. The survey also asked respondents whether they would be interesting in participating in a site visit, and respondents who said yes made up the sample frame for recruiting site visit participants. The RBSA provided an incentive of \$20 to participants who completed the survey, which required an average of 33 minutes to complete, and \$100 to participants who completed a site visit. On average, site visits took 2.6 hours to complete.

The study did not set a formal target for survey completions, but Cadmus estimated that 2,423 respondents would be required to achieve the site visit goals if approximately 20% of survey respondents would go on to complete a site visit. A total of 2,419 participants completed the survey before it was closed on November 30, 2018.

To recruit survey recipients, the study mailed postcards to randomly selected homes within each EDR in sufficient numbers to reach the site visit goals, where practical.

An unexpectedly large number of postcards were needed to recruit the required number of survey completions: the study mailed 138,281 postcards (in addition to an email blast to 3,994 recipients). A relatively small number of survey

participants—197 of 2,419—opted to complete the survey by phone, despite rigorous call attempts to postcard recipients who had not responded. Appendix B of this report provides a detailed breakout of survey disposition, including total calls and call outcome by EDR.

As study team members responsible for completing site visits, Honeywell and PSD each handled recruiting and scheduling site visit participants from the group of survey respondents who expressed a willingness to participate. EDRs were divided among the two companies to avoid confusion during recruiting and to allow each company

to realize efficiencies by focusing on a smaller geographic area.

The recruiting process led to the completion of site visits in 361 existing homes and 95 new homes during the 10 weeks provided for primary data collection. The study was able to meet targets for existing and new homes in most EDRs but, as with the 2015 RSBS, new homes in New York City and Long Island proved especially challenging, largely because of difficulty identifying new homes in those locations. Table 2 shows site visit completions by EDR and home vintage.

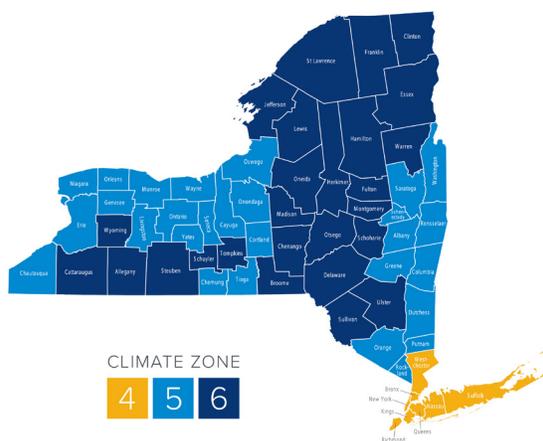
**TABLE 2. SITE VISIT COMPLETIONS BY ECONOMIC DEVELOPMENT REGION AND HOME VINTAGE**

ECONOMIC DEVELOPMENT REGION	EXISTING HOMES	NEW HOMES	TOTAL
Capital District	32	16	48
Central New York	57	7	64
Finger Lakes	44	18	62
Long Island	30	3	33
Mid-Hudson	23	18	41
Mohawk Valley	27	5	32
New York City	53	2	55
North Country	19	10	29
Southern Tier	26	2	28
Western New York	50	14	64
<b>Total</b>	<b>361</b>	<b>95</b>	<b>456</b>

## CLIMATE ZONES

Consistent with the 2015 RSBS, for the purpose of analyzing and presenting results, the RBSA grouped survey and site visit participants into Climate Zones 4, 5, and 6 (shown in Figure 2), as defined in the 2015 International Energy Conservation Code. Table 3 shows the counties included within each Climate Zone.

**FIGURE 2. NEW YORK STATE CLIMATE ZONES**



**TABLE 3. NEW YORK STATE CLIMATE ZONE BY COUNTY**

CLIMATE ZONE 4			
Bronx	Nassau	Queens	Suffolk
Kings	New York	Richmond	Westchester
CLIMATE ZONE 5			
Albany	Erie	Ontario	Saratoga
Cayuga	Genesee	Orange	Schenectady
Chautauqua	Greene	Oswego	Seneca
Chemung	Livingston	Orleans	Tioga
Columbia	Monroe	Putnam	Washington
Cortland	Niagara	Rensselaer	Wayne
Dutchess	Onondaga	Rockland	Yates
CLIMATE ZONE 6			
Allegany	Franklin	Montgomery	Sullivan
Broome	Fulton	Oneida	Tompkins
Cattaraugus	Hamilton	Otsego	Ulster
Chenango	Herkimer	Schoharie	Warren
Clinton	Jefferson	Schuyler	Wyoming
Delaware	Lewis	St. Lawrence	
Essex	Madison	Steuben	

Table 4 shows survey and site visit completes for new and existing homes within each climate zone.

**TABLE 4. SURVEY AND SITE VISIT COMPLETES BY HOME VINTAGE AND CLIMATE ZONE**

CLIMATE ZONE	SURVEY COMPLETES		SITE VISIT COMPLETES	
	EXISTING HOMES	NEW HOMES	EXISTING HOMES	NEW HOMES
Climate Zone 4	<b>515</b>	<b>38</b>	<b>85</b>	<b>5</b>
Climate Zone 5	<b>913</b>	<b>420</b>	<b>206</b>	<b>68</b>
Climate Zone 6	<b>407</b>	<b>126</b>	<b>70</b>	<b>22</b>
<b>Total</b>	<b>1,835</b>	<b>584</b>	<b>361</b>	<b>95</b>

## SURVEY

The RBSA web and phone survey collected data from September 28, 2018 through December 3, 2018, and allowed participation by telephone or web. To allow for comparisons with the 2015 RSBS results, the RBSA survey used most of the same questions verbatim. However, the RBSA survey did add numerous questions and, through a feedback process with NYSERDA, adjusted language in some cases to improve survey performance.

Additional questions for the 2019 RBSA collected information about several characteristics:

- Connected devices
- Smart thermostats
- Number of ductless mini-split heat pumps installed
- Supplemental heating systems
- Willingness to pay at various levels for high-efficiency equipment
- Utility bill payment and assistance

## ON-SITE DATA COLLECTION

The study conducted all site visits between October 10 and December 15, 2018, after a two-day in-person training for Honeywell and PSD project field staff. Under the direction of NYSERDA and Cadmus, PSD managed completion of all new home site visits through contracted Home Energy Rating System (HERS) Raters. PSD also managed completion of 170 existing home site visits, and Honeywell staff completed 191 existing home site visits.

Site data were collected with an iPad data collection tool developed by PSD and based on the tool PSD developed for the 2015 RSBS. For the 2019 RBSA, PSD implemented several

improvements, including an automated check that ensured all required information had been entered before the field technician could complete data submission for a given home.

For the 2019 RBSA, site visit data collection stayed close to 2015 RSBS data scope and methods, including generating a HERS Index score for each new home and running blower door tests on all homes where allowed under Residential Energy Services Network (RESNET) and Building Performance Institute (BPI) standards. New data collected for the 2019 RBSA included information about several types of equipment:

- Connected devices
- Smart thermostats
- LED bulbs
- Extensive information about heat pump systems

The 2019 RBSA does not include data or findings regarding solar photovoltaic (PV) or electrical vehicle (EV) adoption. These data were collected for informational purposes. NYSERDA program data and utility interconnection data can provide close to a census of solar PV projects installed in the State, and Department of Motor Vehicles vehicle registration data can provide a precise count of EVs in use statewide.

## LIMITATIONS

As noted in the Recruiting section above, the RBSA fell well short of meeting targets for new home site visits in the Long Island and New York City EDRs given the short timeline available for recruiting, the inherent challenges of targeting new homes in those areas, and the difficulty of recruiting during the highly active political campaigns of fall 2018. This resulted in a new homes sample size of only five for Climate Zone 4, which is not sufficient to be considered representative. To eliminate the possibility of Climate Zone 4 new homes values skewing other results, the study eliminated data for the five Climate Zone 4 new homes sites when calculating statewide results

and Climate Zone 4 results that would otherwise represent both existing and new homes.

The accelerated timeline for the 2019 RBSA made some strategies used in the 2015 RSBS impractical, such as obtaining random samples of customers from utilities for outreach and recruiting, which provides higher-quality contact information than available through tax assessment data and purchased sample. In addition, for the 2015 study, NYSERDA mailed letters in advance to the utility customers to introduce the study and its importance and to let them know the study would be contacting them. The 2019 RBSA ultimately met data collection targets for most EDRs, but meeting targets within the short amount of time available for recruiting and fieldwork required a heavy reliance on mass mailing postcards.

As noted in some sections of this report, such as Water Heating, survey and site visit data collection sometimes provide much different results for the same home characteristic, such as type of water heater, though results are similar for most characteristics. Appendix A provides results for many characteristics from both survey and site visit data. Where results differ between survey and site visit data, Cadmus endeavored in this report to identify the more credible source using engineering judgement, common sense, informal benchmarking, and other information.

# SUMMARY OF BUILDING AND EQUIPMENT CHARACTERISTICS

Each of the following sections summarizes notable findings for a given equipment category or building component. Findings are presented by climate zone, home vintage, and/or statewide, depending largely on the topic.

Where practical during analysis, Cadmus tested for statistically significant differences between results of the current study and the 2015 RSBS. Cadmus used two-sided t-tests for means and proportions to test the hypotheses that results for the 2019 RBSA for a given population of interest were equal or not equal to 2015 RSBS results. Cadmus identified metrics with significant differences when tests resulted in p-values of  $p < 0.01$ ; the report denotes these differences by ▲▼ symbols to indicate a value that is significantly higher or lower than in the 2015 RSBS results. We did not account for uncertainty of

the 2015 RSBS results and treated them as fixed values.

To streamline presentation of results, this report represents only a high-level view of the collected and analyzed data. In most cases, Cadmus rounded values to whole numbers for better readability. In these instances, values may not sum exactly to 100%. Readers may select the [SEE THE DATA](#) button (presented throughout the report) to view more-detailed tables and additional tables in Appendix A. These tables represent a broader selection of data from the study and include sample sizes and error bounds.



# SECTION 1

## BUILDING CHARACTERISTICS AND DEMOGRAPHICS

The RBSA collected data on building characteristics and energy use through both surveys and site visits. Only the survey collected information about demographics, such as the number and age of occupants in the home, household income, and highest level of education attained. For data points collected through both data collection methods, each method has its advantage and drawbacks.

Conditioned floor area often correlates well with energy usage, but different definitions of the term lead to different numbers. In the RBSA web and telephone survey, questions regarding home size asked for the square feet of living space not including unfinished basements. In contrast, the conditioned floor area collected during site visits conformed to a RESNET definition, which provides somewhat nuanced direction regarding which

spaces should be included. For example, a finished area should always be included in a RESNET conditioned floor area, whether heated or not, while unfinished areas should be included if sufficiently and directly heated.

Data collection also differed somewhat for energy usage between the survey and site visits. Whereas the survey simply asked for an estimate of the cost for each utility or type of fuel over the past year, site visits collected annual usage from bills provided by the participants. Scheduling and reminder calls with participants underscored the importance of making bills available. In contrast, the longer timeline and somewhat different recruiting methodology of the 2015 RSBS allowed energy usage to be provided from utility data for survey participants.

## DEFINITIONS

All data collection included only single-family homes, which for this study were defined as buildings with one to four housing units. The study classified each home as one of four types: single-family detached home, single-family attached home, mobile or manufactured home, or apartment building or condominium. Single-family attached homes abut another structure on one or more sides.

The 2019 RBSA defines existing homes as any single-family home constructed before 2015. New homes are defined as any single-family home constructed in 2015 or after. The study classified

homes as new or existing based primarily on construction dates provided in the State tax assessment data, where available.

The study generated a HERS rating for each new home. With the HERS Index, a score of 100 equates to the score of a standard new home, meaning one that does not exceed energy efficiency levels required by building codes. A home with a HERS rating of 70 is 30% more energy efficient than a standard new home, according to RESNET documentation.

# EXISTING AND NEW HOMES PROFILES FROM SURVEY DATA

	EXISTING HOMES	NEW HOMES
Average HERS Rating (Site Visit)	N/A	55.7▼
Built Before 1940	25%	N/A
Less than 2,000 Sq Ft	59%▼	45%▲
Bedrooms	3.4▲	3.4
Single-Family Detached Homes	88%▲	84%▼
Own or Buying	97%▲	99%
Occupants	2.8	3.1
Annual Household Income of \$75,000 or More	53%▲	57%▼
Highest Education Level of Graduate Degree	39%▲	48%

SEE THE DATA

## KEY FINDINGS

### SAMPLE COMPARISONS

Profile tables for existing and new homes depict somewhat different populations than the 2015 RSBS samples, though differences are typically minor. The 2019 RBSA existing homes sample appears generally representative when compared with data from other sources, such as the 2013–2017 American Community Survey.

### SURVEY AND SITE VISIT SAMPLES

For existing homes, RBSA survey and site visit samples appear similar in size of home. With new homes, the site visit sample appears to skew somewhat to larger homes, but differences in the conditioned area definition in the survey and site visits may contribute.

### NEW HOMES USE LESS

New homes appear to use less energy on average. The weighted average HERS rating dropped from 68.5 for the 2015 RSBS to 55.5 in the current study. As expected, 2019 RBSA data also show that new homes use less energy on average than existing homes.

AVERAGE NUMBER OF HOUSEHOLD MEMBERS BY AGE RANGE

Survey data depict a somewhat **older population in existing single-family homes** than the 2015 RSBS.

OCCUPANT AGES	EXISTING HOMES	NEW HOMES	STATEWIDE
Less than 5 Years	0.2▼	0.3	0.2▼
6 to 17 Years	0.4	0.5	0.4
18 to 24 Years	0.2	0.1	0.2
25 to 34 Years	0.3▼	0.5	0.3▼
35 to 44 Years	0.3	0.5	0.3
45 to 54 Years	0.4	0.4	0.4
55 to 64 Years	0.5^	0.4	0.5^
65 Years or older	0.5^	0.3	0.5^
Total Household Members	2.8	3.1	2.8

SEE THE DATA

CONDITIONED FLOOR AREA FROM SURVEY AND SITE VISIT SAMPLES

Existing home size estimates from survey and site visits **appear similar**. Visited new homes were **somewhat larger**.

Area (Sq Ft)	EXISTING HOMES		NEW HOMES	
	SURVEY	SITE VISITS	SURVEY	SITE VISITS
Less than 1,000	5%▼	5%▼	2%	1%
1,000 to Less than 1,500	23%	20%	14%	11%
1,500 to Less than 2,000	30%	32%^	30%	19%
2,000 to Less than 2,500	21%^	17%	24%	10%▼
2,500 to Less than 3,000	11%^	16%^	15%	21%
3,000 to Less than 4,000	7%	8%	10%	24%
4,000 or More	2%▼	2%▼	6%	15%

SEE THE DATA

EXISTING HOMES ANNUAL ELECTRICITY USAGE FROM SITE VISIT DATA

Distribution of annual electricity usage **differs somewhat** for Climate Zone 4, primarily in the middle ranges.

	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6	
500 kWh or Less	6%	0%	2%	3%
501 to 2,500 kWh	3%▼	3%▼	3%▼	3%▼
2,501 to 6,000 kWh	24%	30%	30%	27%
6,001 to 12,000 kWh	55%▲	49%	41%	51%▲
12,001 to 20,000 kWh	11%	14%	17%	13%
20,001 kWh or More	1%	4%	6%	3%

SEE THE DATA

NEW HOMES ANNUAL ELECTRICITY USAGE FROM SITE VISIT DATA

New homes in Climate Zones 5 and 6 use the **most electricity per home**, but Climate Zone 4 results may not be representative.\*

	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6	
501 to 2,500 kWh	0%	12%	0%	8%
2,501 to 6,000 kWh	75%	17%	24%	19%
6,001 to 12,000 kWh	25%	30%	48%	35%
12,001 to 20,000 kWh	0%	28%	10%	23%
20,001 kWh or More	0%	3%	19%	8%

SEE THE DATA

\*New homes site visit results for Climate Zone 4 cannot be considered representative because of the small sample size. This limitation also influences statewide results.



# SECTION 2

## HEATING AND COOLING

The RBSA collected extensive data on heating and cooling in participants' homes. In the web and telephone survey, respondents reported the type, approximate age, and fuel type of primary heating and cooling equipment. The survey also collected information about thermostats, equipment maintenance, and supplemental heating and cooling systems, including fireplaces and heating stoves. Most of the high-level heating and cooling results discussed in this report are based on survey results because of the larger sample size they provide.

Data collected during the site visits provides the means to verify survey data and dive deeper into the equipment details. Field staff documented the locations of and detailed information about all heating, cooling, and ventilation equipment in each

home. They also took pictures of all nameplates and recorded the make, model number, capacity, efficiency, and year of manufacture of equipment. Nameplates do not always include all data, so field technicians often conducted post-visit research of model numbers to determine the missing data.

If multiple systems were present, the field technician determined with the homeowner which system(s) provide the majority of heating and cooling. They also recorded the percentage of conditioned space served by each heating and cooling system. On-site data collection also included information about thermostats, including setpoints, setbacks, and whether participants used programs to control the heating or cooling.

## CODE/STANDARDS CHANGES

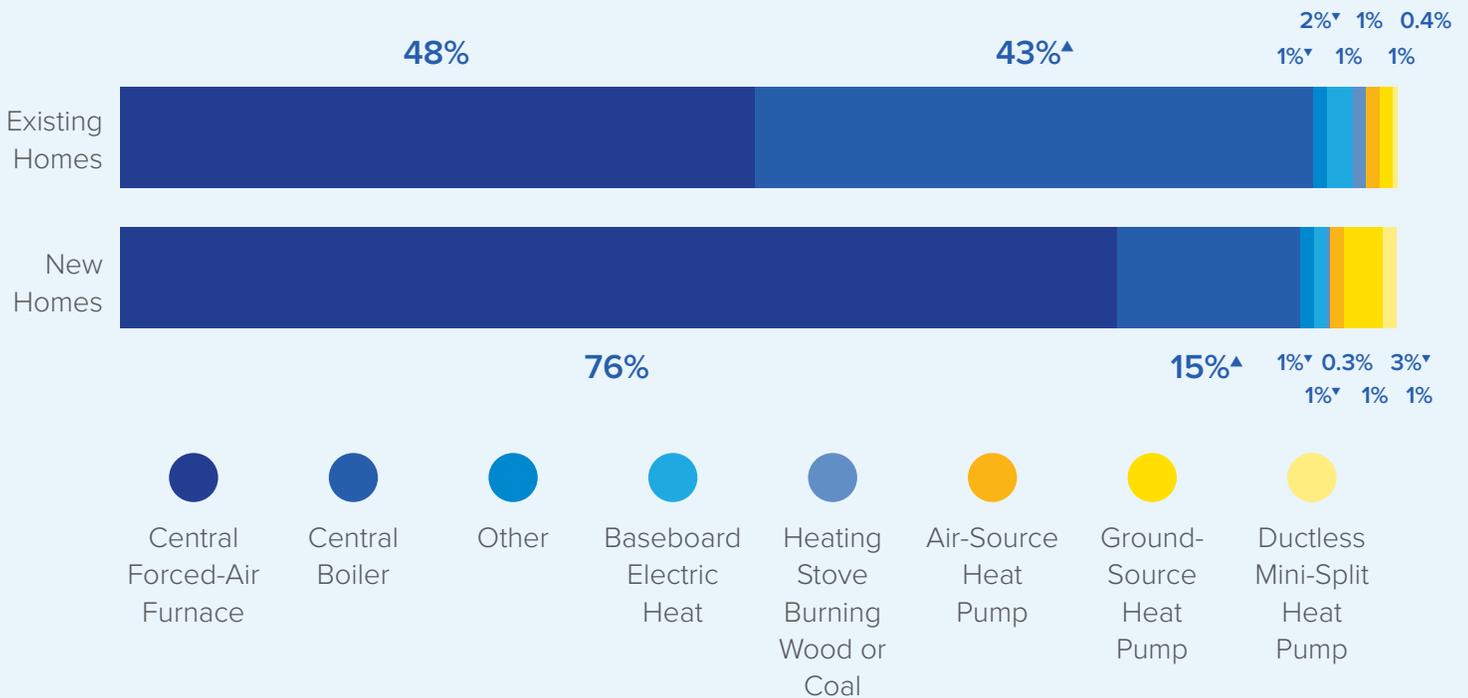
As of January 1, 2015, federal energy standards increased the minimum Seasonal Energy Efficiency Ratio (SEER) of central air source heat pumps from 13 to 14 and their minimum Heating Seasonal Performance Factor (HSPF) from 7.7 to 8.2.

The 2015 changes also used a new, additional definition for room air conditioner efficiency: the Combined Energy Efficiency Ratio (CEER) is similar to the Energy Efficiency Ratio (EER) but includes standby power. Manufacturers must report both

CEER and EER. Minimum CEER values range from 8.7 to 11.0 for 18 product classes, which vary primarily by cooling capacity the presence of louvered sides.

Federal renewable energy tax credits for ground-source heat pumps expired in 2017. Subsequently, after a period of uncertainty, tax credits were renewed for qualifying ground-source heat pumps through 2021, though tax credit levels step down by 4% each year.

Compared with existing homes, a **higher percentage of new homes use a forced-air furnace**, according to survey data.



SEE THE DATA

## KEY FINDINGS

### HEATING REMAINS MUCH THE SAME

The 2019 RBSA shows that a small percentage of homes now use ductless mini-split heat pumps for primary heating, and air source and ground source heat pumps retain a small share. Survey results show a higher percentage of central boiler systems and a lower percentage of electric baseboard heating than the 2015 RSBS, but methodological differences explain those apparent changes.

### MORE HOMES USE AC

Survey data show that significantly more homes use air conditioning in every climate zone. The RBSA estimates that only 10% of existing homes and 7% of new homes have no AC equipment, compared with 15% and 11% in the 2015 RSBS. There also has been a significant shift in existing homes from window and room AC equipment to central AC and heat pumps.

### PRIMARY HEATING FUEL OIL SHARE HAS DECLINED

Natural gas remains the predominate statewide fuel type for primary heating and appears to have gained share, with an estimated 65% of single-family homes statewide using natural gas for primary heating. Fuel oil remains the second most common primary heating type, but its share decreased from 25% in the 2015 RSBS to 19%.

### SMART THERMOSTATS GAINED SHARE

Of homes with central heating or cooling systems, 11% statewide use a smart thermostat, in addition to the 66% using a programmable thermostat. Opportunity remains for both types of thermostats, particularly in Climate Zone 6, where 40% of homes use a manual thermostat.

PRIMARY HEATING FUEL BY CLIMATE ZONE

Estimates based on survey data show **significantly higher natural gas use** for primary heating than in the 2015 RSBS.

SEE THE DATA

	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6		
Natural Gas	67% <sup>▲</sup>	72% <sup>▲</sup>	41% <sup>▲</sup>	65% <sup>▲</sup>	
Fuel Oil	26% <sup>▼</sup>	10% <sup>▼</sup>	20%	19% <sup>▼</sup>	
Electricity	4%	9%	13% <sup>▲</sup>	7%	
Propane	0.2% <sup>▼</sup>	6% <sup>▼</sup>	13%	4% <sup>▼</sup>	
Wood/Wood Pellets	0%	2% <sup>▼</sup>	8% <sup>▼</sup>	2% <sup>▼</sup>	

PRIMARY HEATING EQUIPMENT BY FUEL

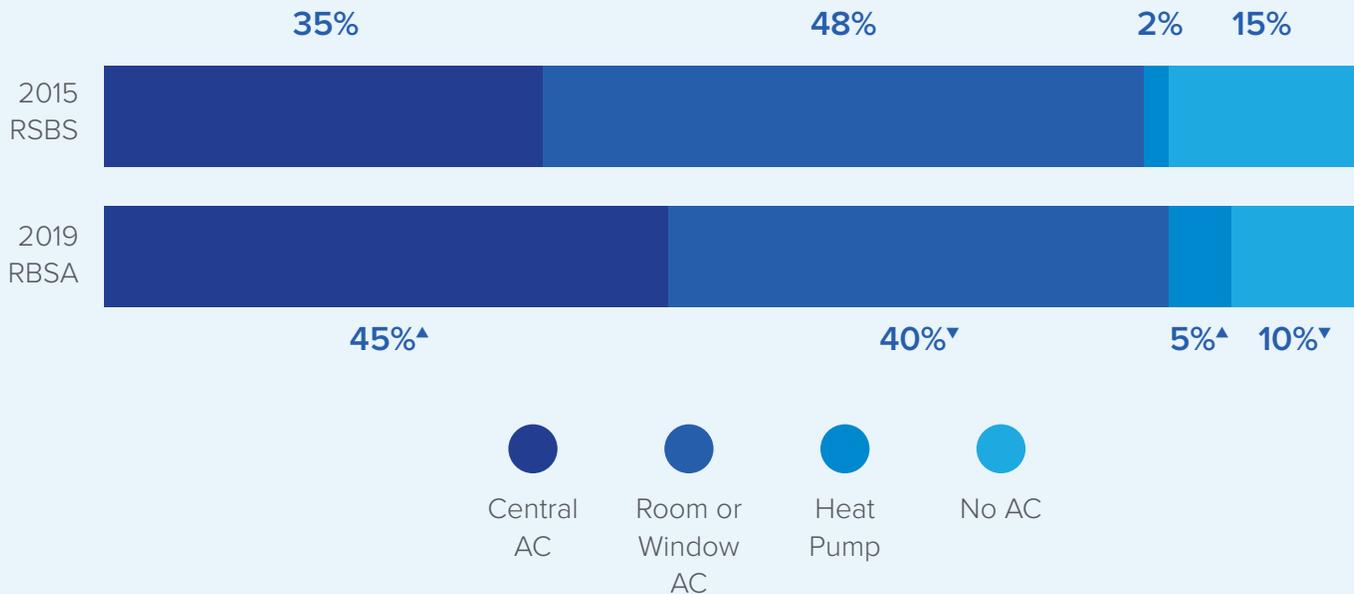
Most primary heating systems using fuel oil **are not ducted**, making upgrades to central furnaces or heat pumps more costly.

SEE THE DATA

	NATURAL GAS	OIL	ELECTRICITY	PROPANE
Central Forced-Air Furnace	59%	26%	33%	59%
Central Boiler	41% <sup>▲</sup>	72% <sup>▲</sup>	0%	36% <sup>▲</sup>
Baseboard Electric Heat	0%	0%	28%	0%
Air Source Heat Pump	0%	0%	17% <sup>▲</sup>	0%
Ground Source Heat Pump	0%	0%	11% <sup>▲</sup>	0%
Ductless Mini-Split Heat Pump	0%	0%	6%	0%

## CHANGES IN PRIMARY COOLING EQUIPMENT TYPES

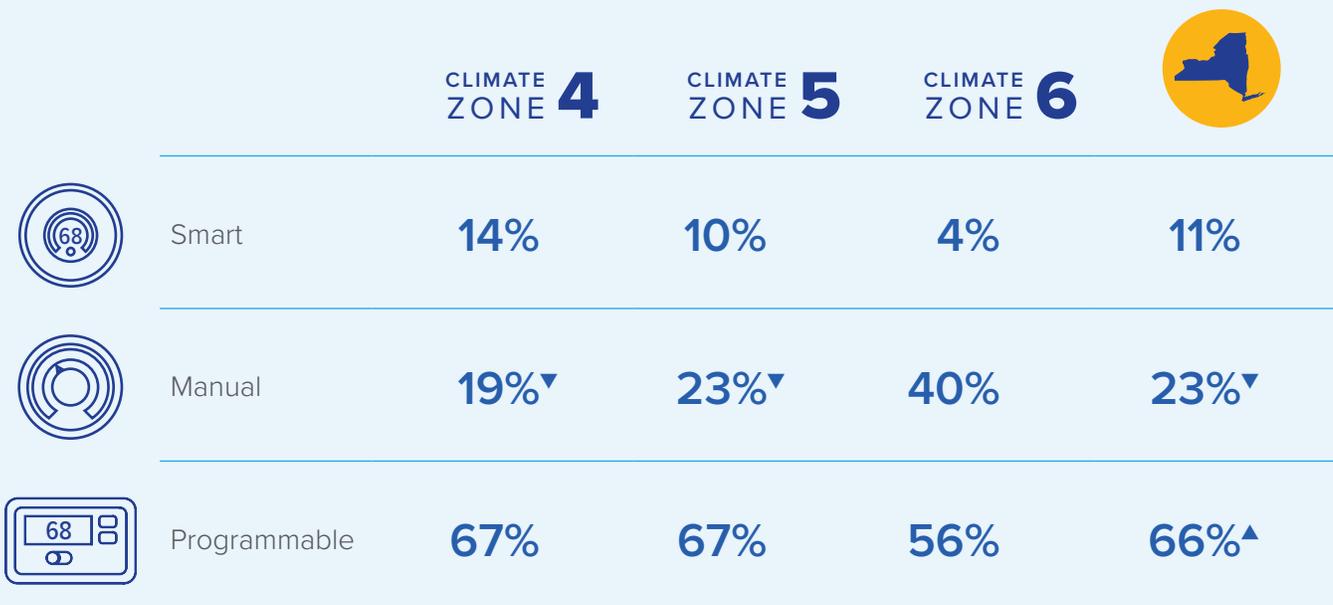
Survey data show a **significant decrease in homes without AC**, along with an **increase in central AC and heat pump systems**.



SEE THE DATA

## THERMOSTAT TYPE BY CLIMATE ZONE

Smart thermostats have captured **more than 10% of thermostat share statewide** among homes with central heating or cooling.



SEE THE DATA



# SECTION 3

## WATER HEATING

Field technicians identified and characterized all water heaters in each home. Technicians recorded the water heater and fuel type, storage volume, energy factor (EF), recovery efficiency, tank insulation characteristics, pipe insulation characteristics, venting configuration and size, and yellow label (EnergyGuide) energy cost values. They also took pictures of the nameplate and recorded the make and model number and year of manufacture. Technicians recorded the general location of the water heater, specifying whether it was located in a conditioned or unconditioned space. Location information is especially noteworthy for heat pump water heaters, because it can affect both the performance of the water heater and the home heating and cooling load.

The web and telephone survey also collected basic information about water heating, though with mixed results. When compared with site visit data, the water heating fuel reported by survey participants appeared generally accurate. Survey data regarding water heater type appeared less reliable. For example, a surprisingly large percentage of survey recipients reported using a heat pump water heater, which proved inaccurate when compared with site visit data and other available information. Accordingly, results discussed here draw from survey data for water heating fuel, to leverage the larger sample size and allow for directional comparisons to the 2015 RSBS data, but rely on site visit data for water heater type.

## CODE/STANDARDS CHANGES

In 2015, the National Appliance Energy Conservation Act raised the federal minimum efficiency for the most common types of storage water heaters. The new minimum EF value of 2.0 for electric residential water heaters with a storage volume more than 55 gallons effectively prohibits the sale of residential electric resistance water heaters of that size, because the EF of 2.0 can only be achieved by a heat pump water heater. For electric water heaters with storage volume less

than 55 gallons, the minimum EF increased modestly to 0.95.

Similarly, the act requires a higher minimum EF for gas storage water heaters above 55 gallons. For example, the minimum EF for a 60-gallon gas-fired water heater increased from 0.56 to 0.75, which effectively requires a condensing design

Survey data show a **significant shift to natural gas water heating** in each climate zone.

	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6		
Natural Gas	71% <sup>▲</sup>	72% <sup>▲</sup>	40% <sup>▲</sup>	67% <sup>▲</sup>	
Electricity	7%	16% <sup>▼</sup>	32% <sup>▼</sup>	14% <sup>▼</sup>	
Fuel Oil	21% <sup>▼</sup>	5%	10%	14% <sup>▼</sup>	
Propane	0% <sup>▼</sup>	6% <sup>▼</sup>	15%	5% <sup>▼</sup>	
Solar	0%	0%	0.8%	0%	

SEE THE DATA

## KEY FINDINGS

### GAS WATER HEATING GAINS SHARE

Weighted survey results show a significant drop statewide in the percentage of single-family homes using electricity, fuel oil, and propane for water heating and a significant increase in natural gas water heater share. According to those data, 67% of single-family homes statewide use natural gas water heating, up from 54% in the 2015 RSBS, though it seems likely that some of that apparent shift results from methodological differences.

### NEW HOMES ADOPT NEWER TECHNOLOGY

On-demand water heaters are much more common in new homes than in existing, with a share of about 26%. Heat pump water heaters and heating water with ground-source heat pumps are also more common in new homes, with estimated shares of 7% and 6%, respectively.

### EFFICIENCY STANDARDS MAY HAVE LITTLE EFFECT

RBSA site visit data indicate that only 7% of all storage water heaters in the State have a capacity of greater than 55 gallons, leaving most households unaffected by the most stringent standards.

## WATER HEATER FUEL BY DATA SOURCE

Estimated fuel shares from site visit data **tracked closely with those from survey data.**



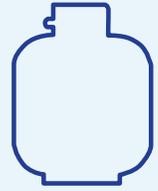
NATURAL GAS



ELECTRICITY



FUEL OIL



PROPANE

	NATURAL GAS	ELECTRICITY	FUEL OIL	PROPANE
SITE VISITS	69%	12%	15%	3%
SURVEY	67% <sup>▲</sup>	14% <sup>▼</sup>	14% <sup>▼</sup>	5% <sup>▼</sup>

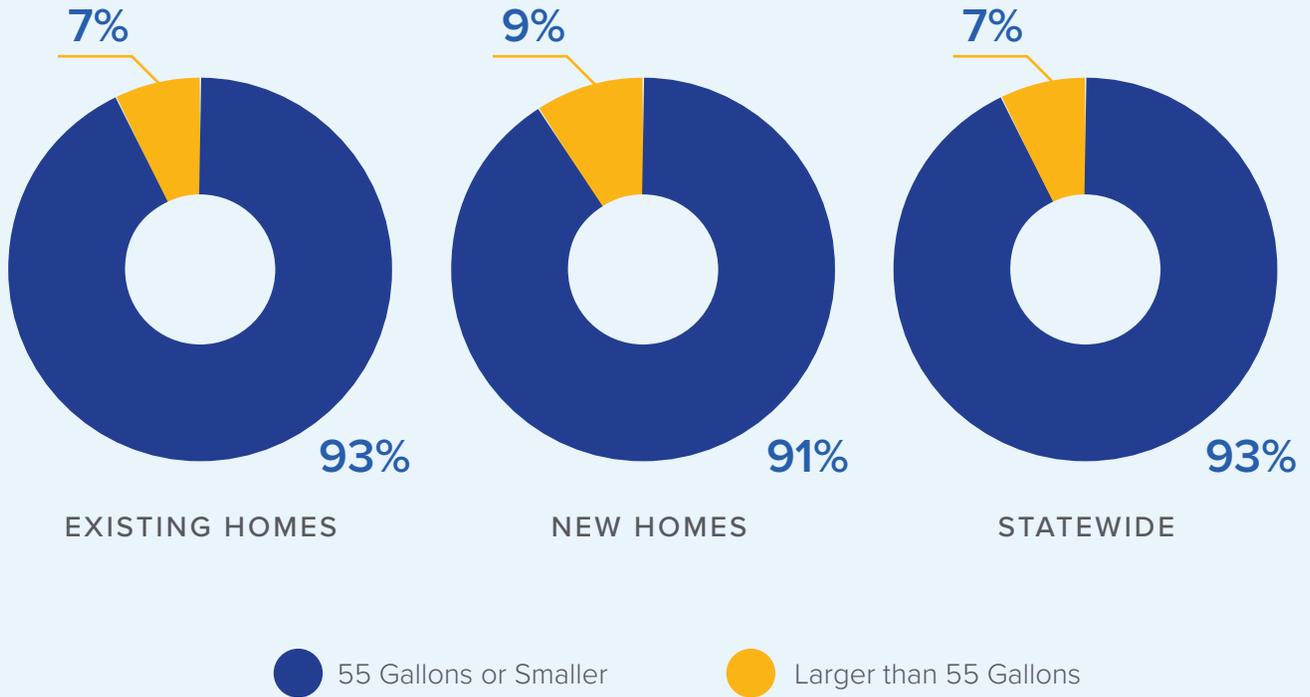
## WATER HEATER TYPE BY HOME VINTAGE

On-demand water heaters and heat pump variants have a **higher share in new homes** than in existing homes.

	EXISTING HOMES	NEW HOMES
Storage Tank Water Heater	75%	60%
Space Heating Boiler with Tank	14%	2%
Tankless/On-Demand	7%	25%
Space Heating Boiler with Coil	4%	0%
Heat Pump Water Heater	0.4%	7%
Ground Source Heat Pump with Tank	0.4%	6%

## STORAGE WATER HEATER TANK SIZE

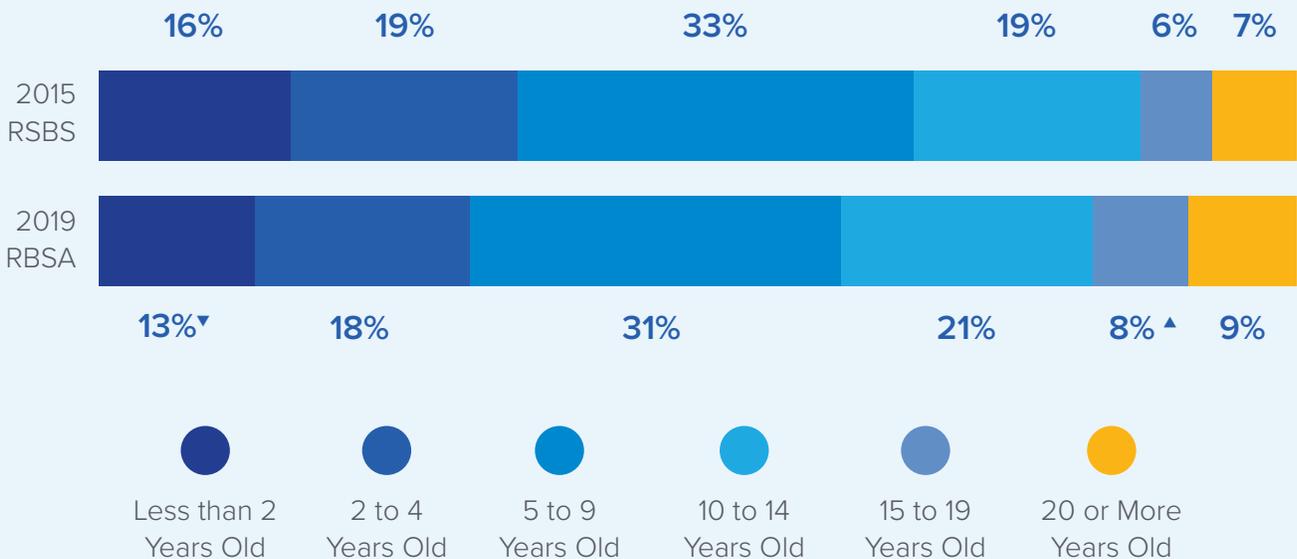
Storage water heaters larger than 55 gallons **must achieve much higher energy efficiency ratings** under federal standards.



SEE THE DATA

## WATER HEATER AGE

Based on survey data, **17% of water heaters** have reached the end of their estimated useful life of 15 years.



SEE THE DATA



# SECTION 4

## BUILDING SHELL

The 2019 RBSA collected a variety of information about the building shell (or envelope) of each home during site visits, including the thickness and type of installed insulation in the ceilings, walls, foundation walls, and floors that make up the thermal boundary of the home. As with the 2015 RSBS, site visits also included a blower door test except where BPI or RESNET standards precluded such testing or where conditions would make it difficult to produce reliable results.

Blower door results included here show air leakage in air changes per hour at 50 Pascals (ACH50) and cubic feet per minute at 50 Pascals (CFM50), with 50 Pascals being the pressure used for the blower door test. Expressing air leakage in air changes per hour takes the size of the home into account to allow for more meaningful comparisons.

Consistent with the 2015 RSBS, surfaces characterized as foundation refer to the exterior walls of foundation spaces—namely basements and

crawlspaces. Floors correspond to floors over outside or over unconditioned spaces such as garages or vented crawlspaces. Field staff also characterized floors over unconditioned basements, but in the great majority of cases these basements were arguably indirectly conditioned, and floors above them should not be considered the thermal boundary of the home.

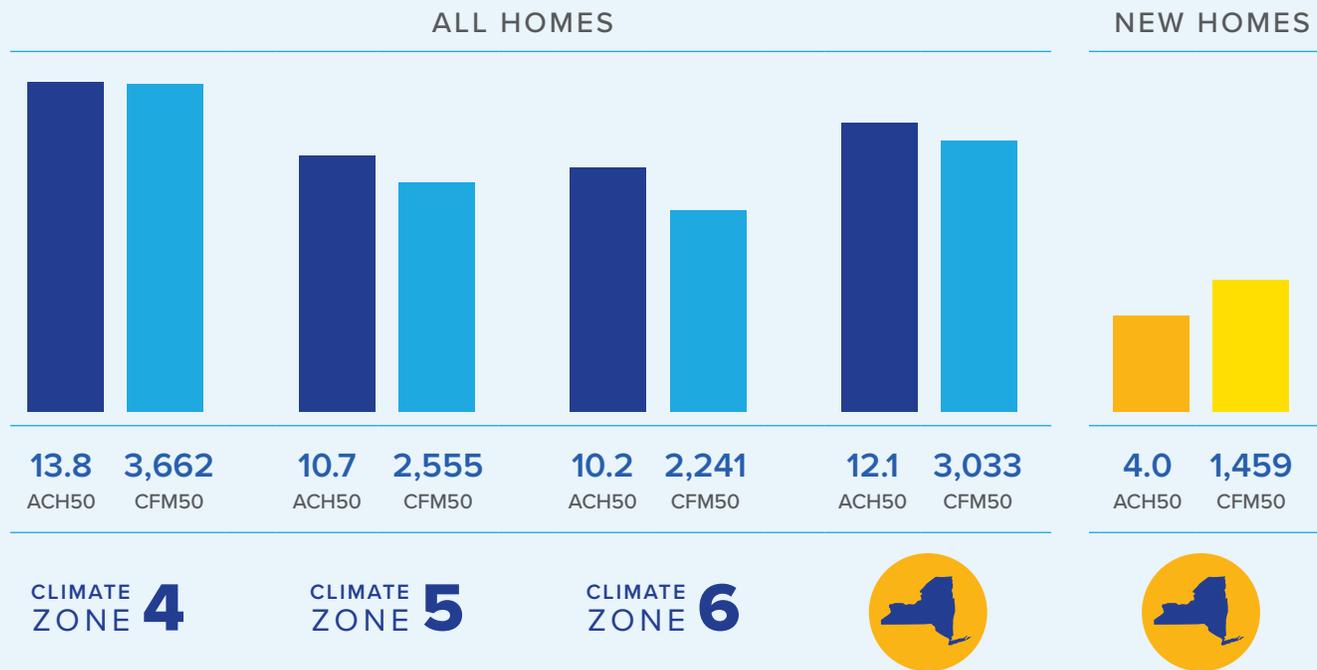
During site visits, field staff defined like areas of envelope surface, such as walls with the same apparent type and thickness of insulation, as one segment. The field technician also reported the percentage of the total surface of that type (walls, for example) made up by that segment. Tables that present results for these envelope surfaces use these percentage values for each segment when calculating distributions of characteristics such as insulation thickness. Sample size values reported in these tables correspond to the number of defined segments.

## CODE/STANDARDS CHANGES

Building codes apply to existing homes only when portions of the home are being extensively remodeled or area is being added. New homes in the State outside of New York City are subject to codes such as the State Uniform Fire Prevention and Building Code (Uniform Code) and the State Energy Conservation Construction Code (Energy

Code). Buildings in New York City are subject to the New York City Construction Code and New York City Energy Conservation Code. Both jurisdictions updated energy codes in 2016, with the State Energy Code incorporating the 2015 International Energy Conservation Code, with amendments.

Blower door testing showed **significant potential** among existing homes.



SEE THE DATA

## KEY FINDINGS

### NEW HOMES LEAK LESS

Blower door testing shows much less air leakage in new homes than existing homes, with average ACH50 of 4.0. More than half of the homes tested appear to exceed the 3.0 ACH50 requirement imposed statewide by energy codes in 2016, though many of the new homes represented here began construction before those codes went into effect (and before blower door tests were required by code).

### AIR SEALING POTENTIAL REMAINS

Blower door testing showed lower air leakage on average in Climate Zones 5 and 6 than Climate Zone 4, but potential remains throughout the State. Results estimate that just over 50% of homes statewide would test at ACH50 of 10.0 or more.

### INSULATION OPPORTUNITIES EXIST

More than 65% of ceilings statewide have eight inches of insulation or less. Eight inches of insulation generally equates to an R-value of 20 to 30, well under the R-49 required in new homes or additions by current State code. Exterior walls, foundation walls, and floors over garages, vented crawlspaces, and outside also show room for improvement, with all having a significant percentage of uninsulated segments.

### FEW SINGLE-PANE WINDOWS REMAIN

With a significant reduction in every climate zone relative to the 2015 RSBS, few single-pane windows without storm windows remain—only 3% by window area. Windows with single-pane glazing and with storm windows make up roughly 10% of windows by window area.

Climate Zones 5 and 6 show **lower ACH50** than Climate Zone 4 but still have room for improvement.



ACH50	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6	
Less than 5	5%	15%	24%	12%
5 to Less than 10	32%	48%	30%	38%
10 to Less than 15	30%	20%	32%	27%
15 to Less than 20	20%	7%	8%	13%
More than 20	12%	11%	6%	11%
Mean	13.8	10.7	10.2	12.1

SEE THE DATA

PERCENTAGE OF SURFACES WITH NO INSULATION BY CLIMATE ZONE

All surface types show a **significant percentage of uninsulated segments**, though not all can feasibly be insulated.



	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6	
Ceilings	11% <sup>▲</sup>	5% <sup>▲</sup>	0.1%	7% <sup>▲</sup>
Walls	29%	18%	9%	22%
Foundation Walls	58% <sup>▼</sup>	70%	71%	65% <sup>▼</sup>
Floors*	13%	30%	0%	17%

\*Represents floors over garages, over outside areas, and over vented crawlspaces only.

SEE THE DATA

EXISTING HOMES CEILING INSULATION THICKNESS BY CLIMATE ZONE

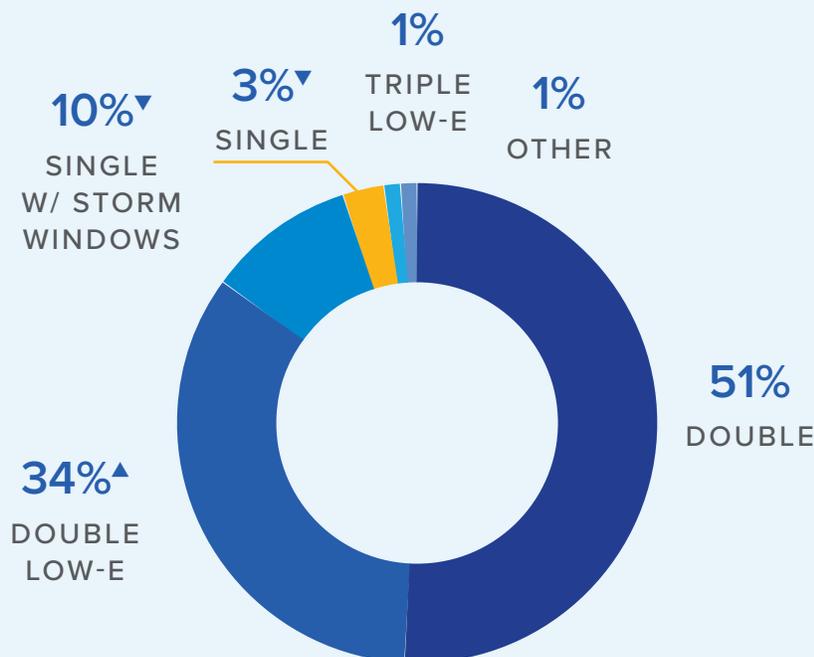
More than **65%** of ceilings statewide have eight inches of insulation or less.

INCHES	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6	
0	11% <sup>▲</sup>	5% <sup>▲</sup>	0.1%	7% <sup>▲</sup>
1.0 to 3.0	14%	7%	5%	10%
3.5 to 5.0	13%	7% <sup>▼</sup>	5% <sup>▼</sup>	10% <sup>▼</sup>
5.5 to 8.0	43%	36%	36%	39%
9.0 to 12.0	14%	31%	34%	23%
13.0 to 16.0	3%	11% <sup>▲</sup>	15%	8% <sup>▲</sup>
17.0 to 20.0	1%	4%	2%	2%
21.0 to 24.0	0%	0%	3%	0.4%

SEE THE DATA

EXISTING HOMES WINDOW GLAZING

As little as **3%** of **single-pane windows** without storm windows remain statewide.



SEE THE DATA



# SECTION 5

## LIGHTING

For lighting data collection, field technicians recorded the quantity and type of bulbs for each room or space type, along with fixture and control type where controls went beyond simple on/off switches. Field technicians collected this data for lighting both inside and outside the home, including bulbs stored for future use.

Where necessary and reasonable, technicians removed lampshades or fixture covers to identify the bulb characteristics. When a given data point could not be identified by visual inspection, field technicians attempted to gather the information from another source, such as the homeowner, or noted that they were unable to identify the bulb type.

Identifying bulb type can be difficult due to accessibility or safety issues, and discerning halogen

from incandescent bulbs can be especially challenging. Accordingly, data collected during site visits combined incandescent and halogen bulbs into one category labeled “inefficient.”

Although the RBSA captured data on CFL and LED bulbs separately, some lighting tables combine CFL and LED bulbs into one category to allow for direct comparisons with 2015 RSBS results.

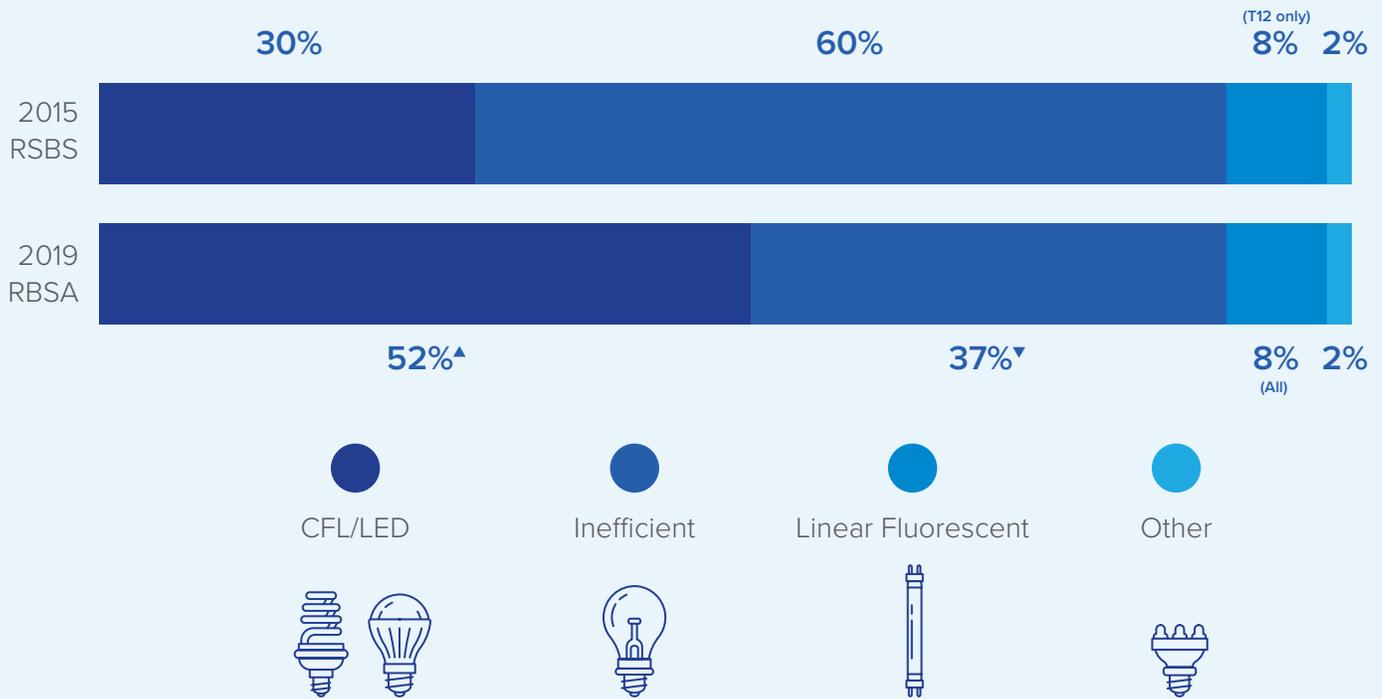
As with the 2015 RSBS, the web and telephone survey also collected information about bulbs, but only for those used two or more hours a day. Accordingly, the survey results cannot be directly compared with the site visit results, but they do allow for comparisons with the 2015 RSBS survey data.

## CODE/STANDARDS CHANGES

The Energy Independence and Security Act of 2007 defined high-efficiency standards for common household lighting. These standards, which phased in between January 1, 2012 and January 1, 2014, likely played a large role in accelerating a shift away from incandescent bulbs. Many specialty bulbs

using incandescent designs are still available, such as appliance lamps, three-way bulbs, and others. Additional federal lighting standards may go into effect in August 2021.

Energy efficient lighting makes up **more than half of all bulbs installed in homes.**



SEE THE DATA

## KEY FINDINGS

### LEDS TAKE THE LEAD

LED has surpassed CFL as the high-efficiency bulb technology of choice. Site visit data found 34% LED bulbs on average statewide, compared with 18% CFLs.

### EFFICIENT BULBS GAIN SHARE

LEDs and CFLs combined now account for 52% of installed bulbs statewide, up from 30% in the 2015 RSBS.

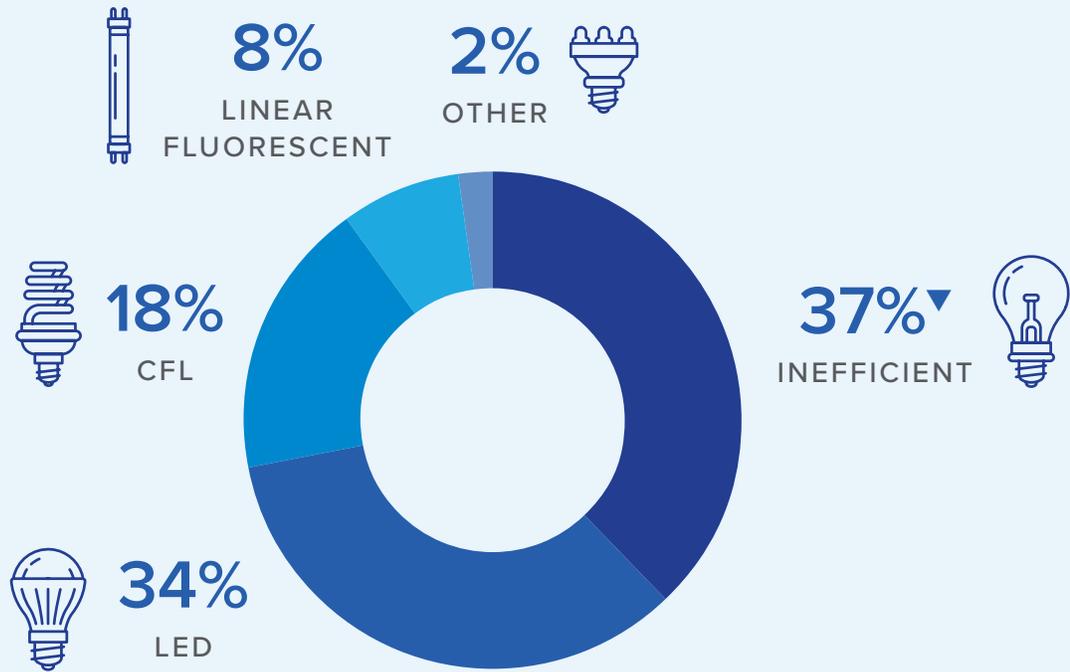
### POTENTIAL REMAINS

Despite the rapid transformation of the lighting market, opportunity remains. Site visit data show that inefficient lamps fill more than one-third of sockets, at 37% statewide, though this is down significantly from 60% in the 2015 RSBS.

### NEW HOMES, OLD BULBS

New homes boast 78% efficient lighting overall, but site visit data show that 37% of bulbs in storage are inefficient bulbs, which could replace efficient bulbs in future years.

**LEDs represent one-third** of all bulbs installed (34%), surpassing CFLs (18%).



PERCENTAGE OF EFFICIENT LIGHTING IN NEW AND EXISTING HOMES

New homes have a **much higher percentage of efficient lighting** (78%) than existing homes (52%).

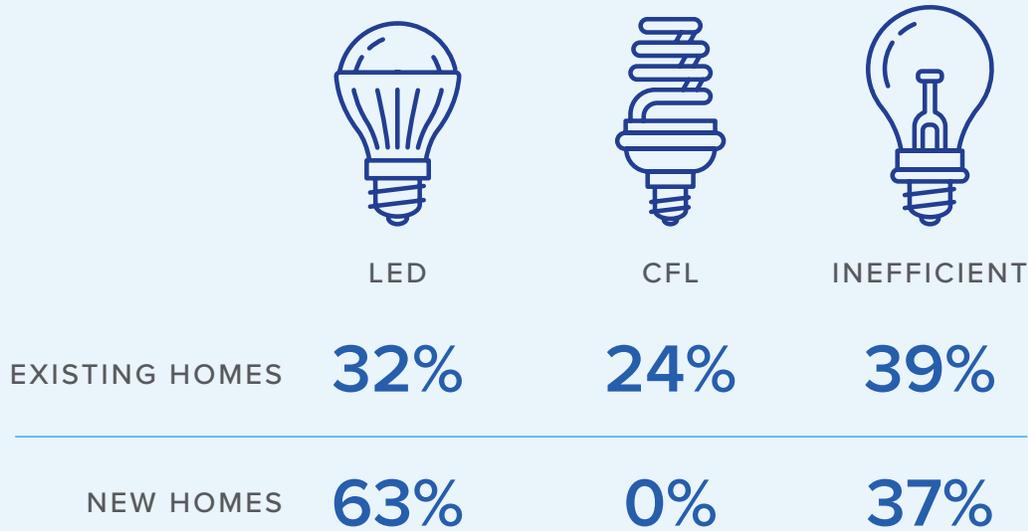
	INEFFICIENT	LED	CFL	LINEAR FLUORESCENT	OTHER
EXISTING HOMES	37%▼	34%	18%	9%	2%
NEW HOMES	16%▼	62%	16%	2%	3%

SEE THE DATA

SEE THE DATA

BULBS IN STORAGE BY HOME VINTAGE

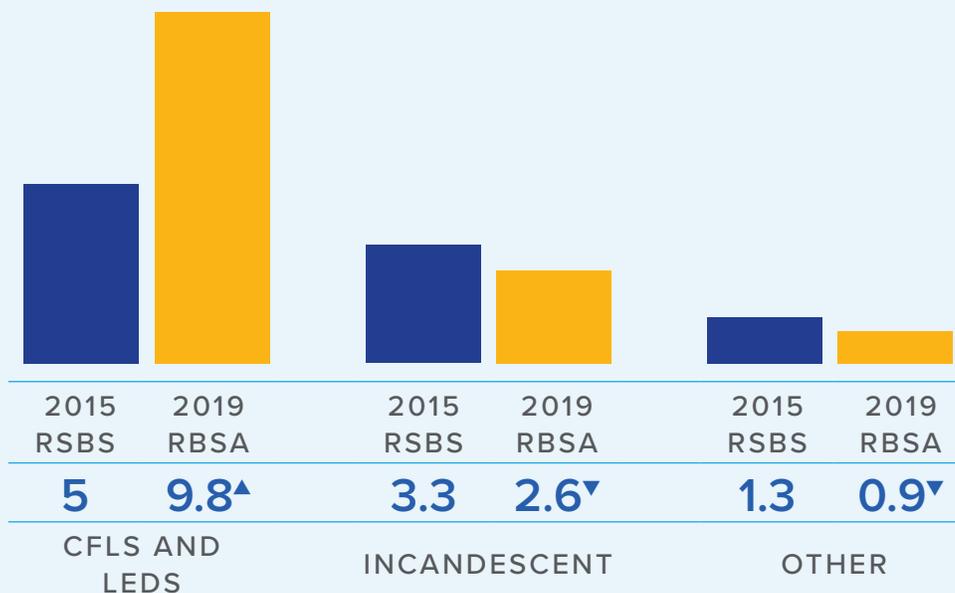
**Incandescents still outnumber** other stored bulbs, but LEDs are close behind in existing homes and have taken the lead in new homes.



SEE THE DATA

AVERAGE NUMBER OF INTERIOR BULBS USED AT LEAST TWO HOURS PER DAY

Survey data show a **dramatic increase** in the number of **CFL or LED bulbs** used at least two hours a day.



SEE THE DATA

# DISTRIBUTION OF BULB TYPE BY ROOM

## BATHROOM

CFL 18%  
Inefficient 46%  
LED 34%  
Linear Fluorescent 1%

## DEN/OFFICE

CFL 19%  
Inefficient 39%  
LED 32%  
Linear Fluorescent 9%

## CLOSET

CFL 20%  
Inefficient 36%  
LED 21%  
Linear Fluorescent 23%

## BEDROOM

CFL 24%  
Inefficient 39%  
LED 32%  
Linear Fluorescent 3%

## LIVING ROOM

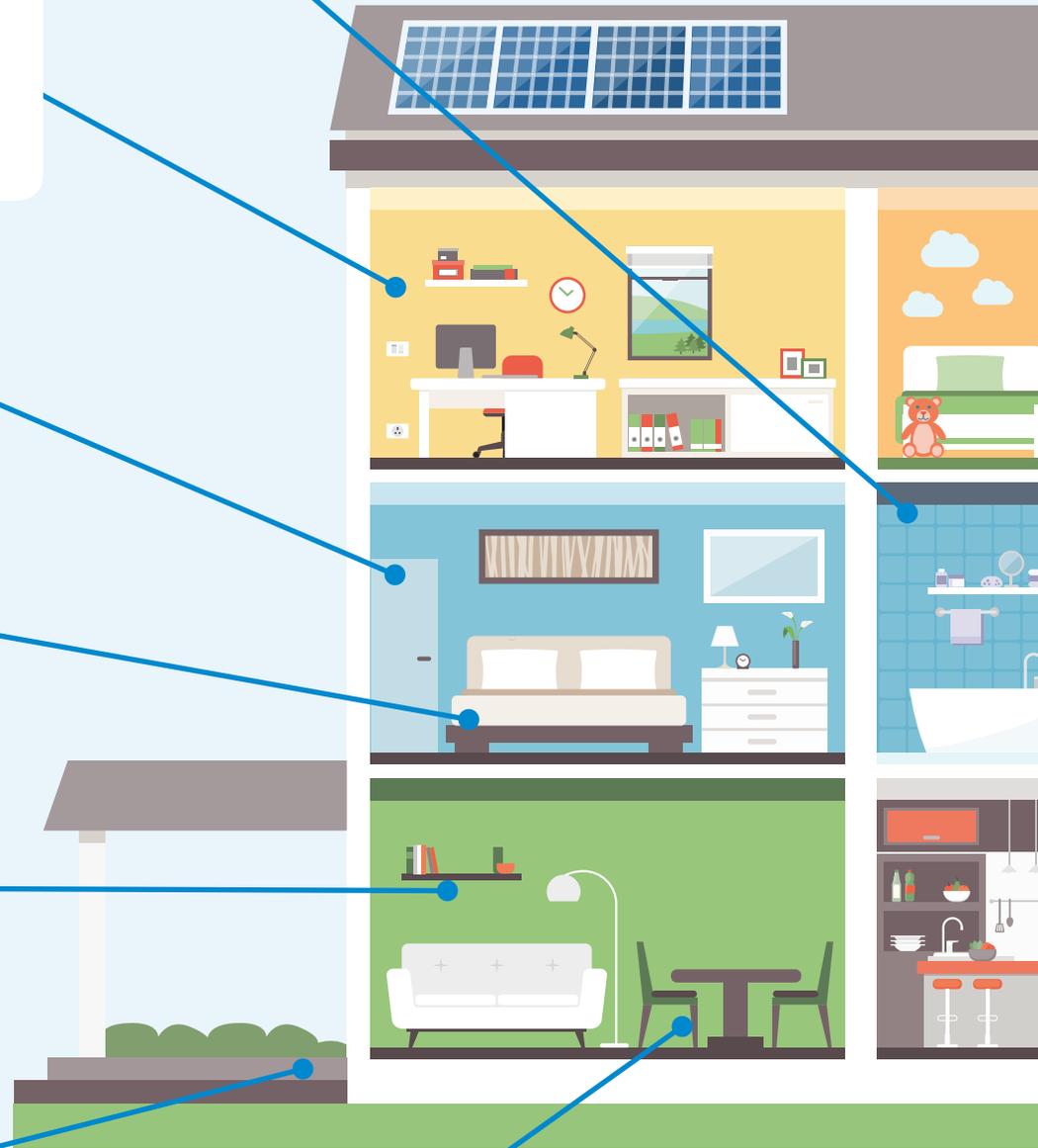
CFL 21%  
Inefficient 38%  
LED 39%  
Linear Fluorescent 1%

## ENTRYWAY

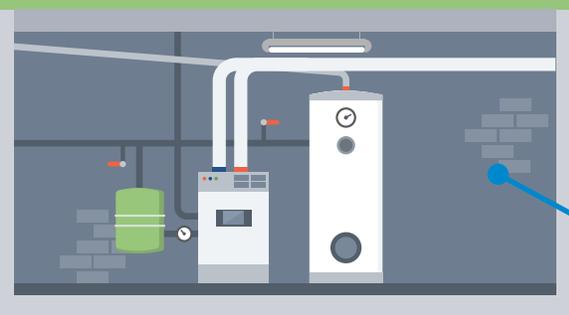
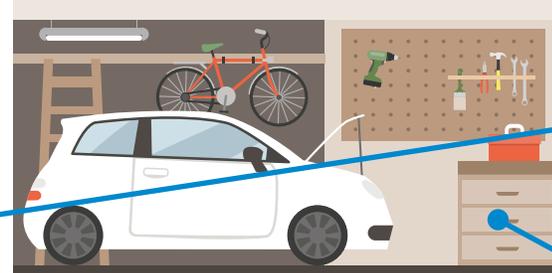
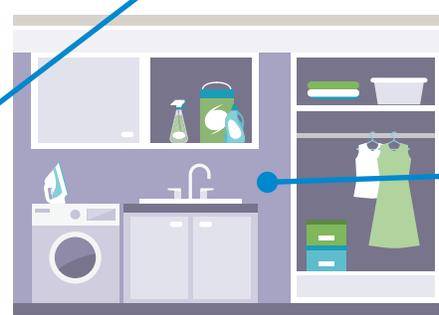
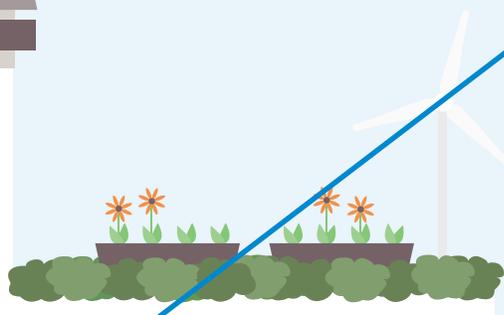
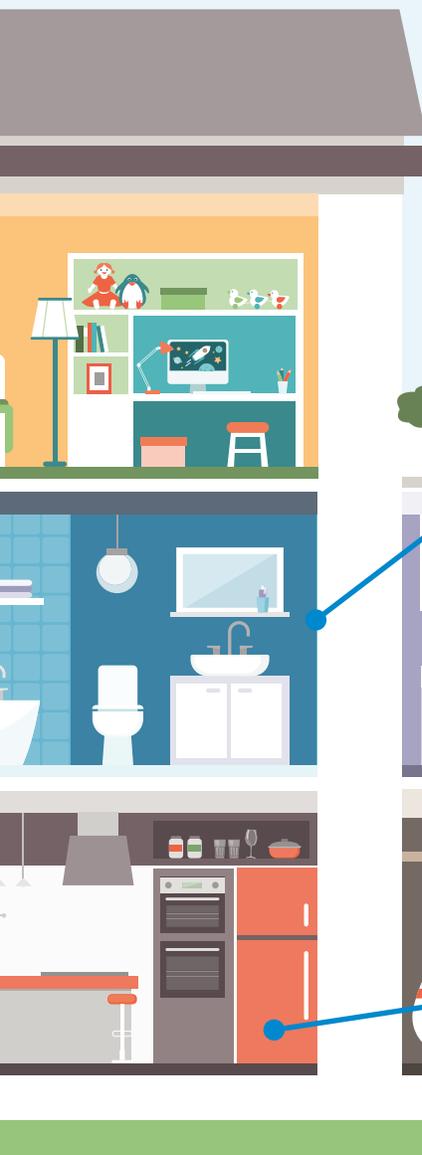
CFL 16%  
Inefficient 53%  
LED 28%  
Linear Fluorescent 1%

## DINING ROOM

CFL 9%  
Inefficient 47%  
LED 40%  
Linear Fluorescent 1%



SEE THE DATA



### OTHER

CFL 37%  
 Inefficient 23%  
 LED 32%  
 Linear Fluorescent 8%

### HALLWAY

CFL 24%  
 Inefficient 36%  
 LED 38%  
 Linear Fluorescent 1%

### EXTERIOR

CFL 15%  
 Inefficient 45%  
 LED 31%  
 Linear Fluorescent 1%  
 Other 9%

### LAUNDRY

CFL 20%  
 Inefficient 24%  
 LED 30%  
 Linear Fluorescent 26%

### KITCHEN

CFL 12%  
 Inefficient 32%  
 LED 44%  
 Linear Fluorescent 8%

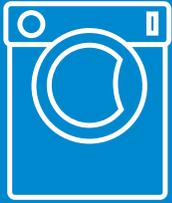
### GARAGE

CFL 16%  
 Inefficient 28%  
 LED 19%  
 Linear Fluorescent 36%

### UTILITY

CFL 16%  
 Inefficient 24%  
 LED 26%  
 Linear Fluorescent 34%

SEE THE DATA



# SECTION 6

## APPLIANCES

Homeowners tend to know more about their appliances than about some other building characteristics, and the RBSA leveraged that knowledge with an abundance of questions on primary and additional appliances. Survey questions asked not only about the appliance units but also about patterns of usage, such as the number of loads per week where applicable. As with other equipment categories, most questions stayed at least close to those asked in the 2015 RSBS to allow for direct comparisons with the 2015 RSBS results.

Field technicians also collected information about each major appliances during site visits, including year of manufacture, type, fuel, whether it was labeled as ENERGY STAR rated, and for some appliances EnergyGuide information and/or model number. Where model numbers were collected, field staff attempted to look up characteristics such as ENERGY STAR status and EnergyGuide information online.

Appliances provide some striking examples of the differences between surveys and site visits as a

means of primary data collection. On one hand, all survey respondents will presumably know how many of each type of major appliance is in their home, along with the basic type or configuration of each appliance. As illustrated in the ENERGY STAR appliances table below, however, a survey participant's knowledge or memory of whether each appliance is ENERGY STAR rated may be understandably limited.

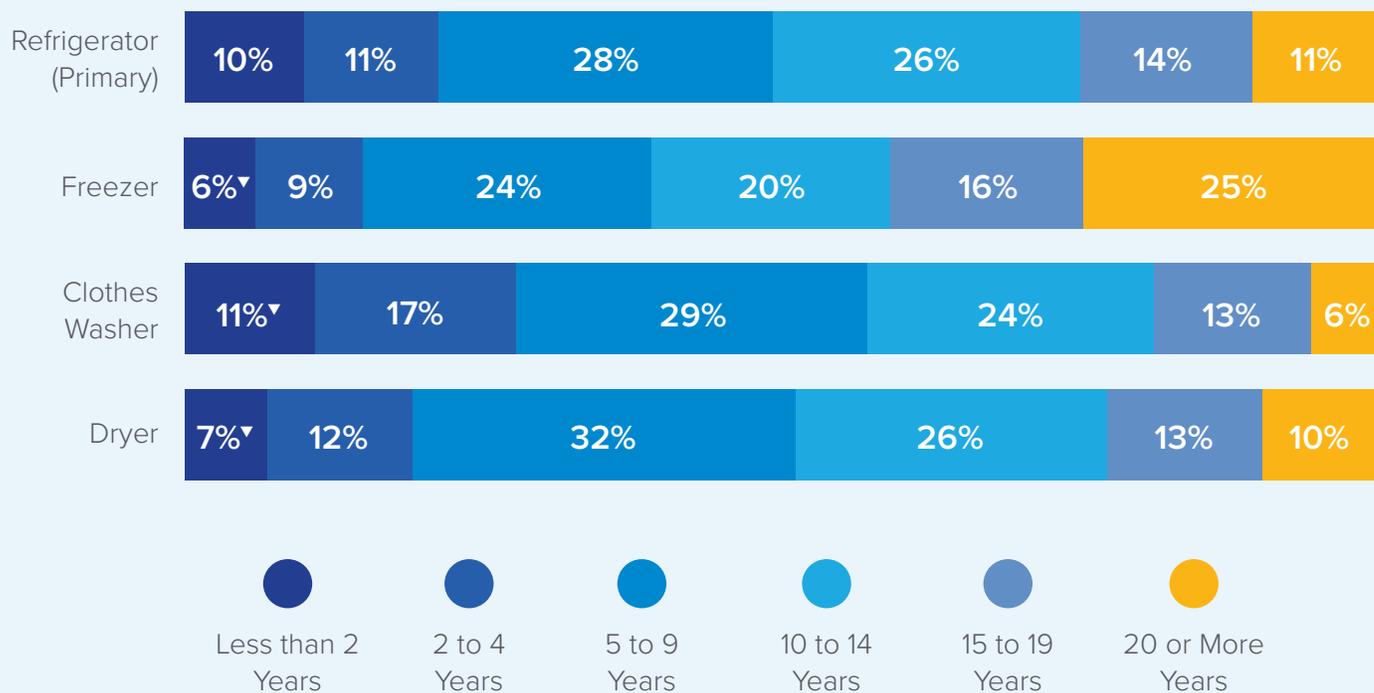
The ability of field staff to consistently identify ENERGY STAR appliances with accuracy is also up for debate. For this project, for instance, field staff were instructed to look for an ENERGY STAR label and, if not present, to search online for ENERGY STAR status, but it is likely that the site visit data somewhat underestimated the percentage of installed ENERGY STAR appliances because of missing or inaccessible labels. Where collected, model numbers are provided in the site visit data for implementers or researchers who need to determine with more certainty the percentage of qualifying ENERGY STAR appliances.

## CODE/STANDARDS CHANGES

Federal energy efficiency standards can have a significant impact on appliance stock and efficiencies in particular. Appliances impacted by

federal efficiency changes during the past five years include refrigerators and freezers (2014) and clothes dryers (2015).

**Roughly one-half** of appliances are **10 years or older**, according to site visit data.



SEE THE DATA

## KEY FINDINGS

### OLD APPLIANCES

About one-half of appliances are 10 years or older, based on site visit data. Clothes washers have the lowest percentage that are at least 10 years old (43%) while stand-alone freezers have the highest (61%).

### MULTIPLE REFRIGERATORS AND FREEZERS

One in four single-family homes statewide has a second refrigerator, and one in three has at least one stand-alone freezer, according to survey data. One in eight homes has at least one compact refrigerator. According to site visit data, 11% of refrigerators and 57% of stand-alone freezers are located in unconditioned spaces such as a garage.

### FUEL DIFFERENCES

Survey data show a significantly larger percentage of homes using natural gas clothes dryers than in the 2015 RSBS, at 43% instead of 32%. Electric clothes dryers make up 54%, compared with 64% in the previous study, and propane usage is down from 4% to 3%.

### ENERGY STAR APPLIANCES

As with the 2015 RSBS, survey respondents reported a much higher incidence of ENERGY STAR appliances less than 10 years old than identified through site visits. Survey results for the 2019 RBSA show significantly higher percentages of ENERGY STAR appliances than reported in the previous study, but site visit data showed no significant changes.

HOMES WITH MULTIPLE REFRIGERATORS AND FREEZERS

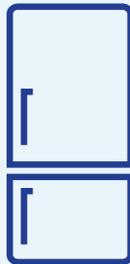
**One-quarter of homes** statewide have two full-size refrigerators.  
**One-third** have at least one stand-alone freezer.

NUMBER	FULL-SIZE REFRIGERATORS	COMPACT REFRIGERATORS	STAND-ALONE FREEZERS
0	0.4%	86%	66%
1	71%	13%	32%
2	25%	1%	2%
3	3%	0.1%	0.2%

SEE THE DATA

REFRIGERATOR AND FREEZER LOCATION

**More than half** of stand-alone freezers are in an unconditioned space.



REFRIGERATOR



FREEZER

CONDITIONED

89%

43%

UNCONDITIONED

11%

57%

SEE THE DATA

## CLOTHES DRYER FUEL TYPE

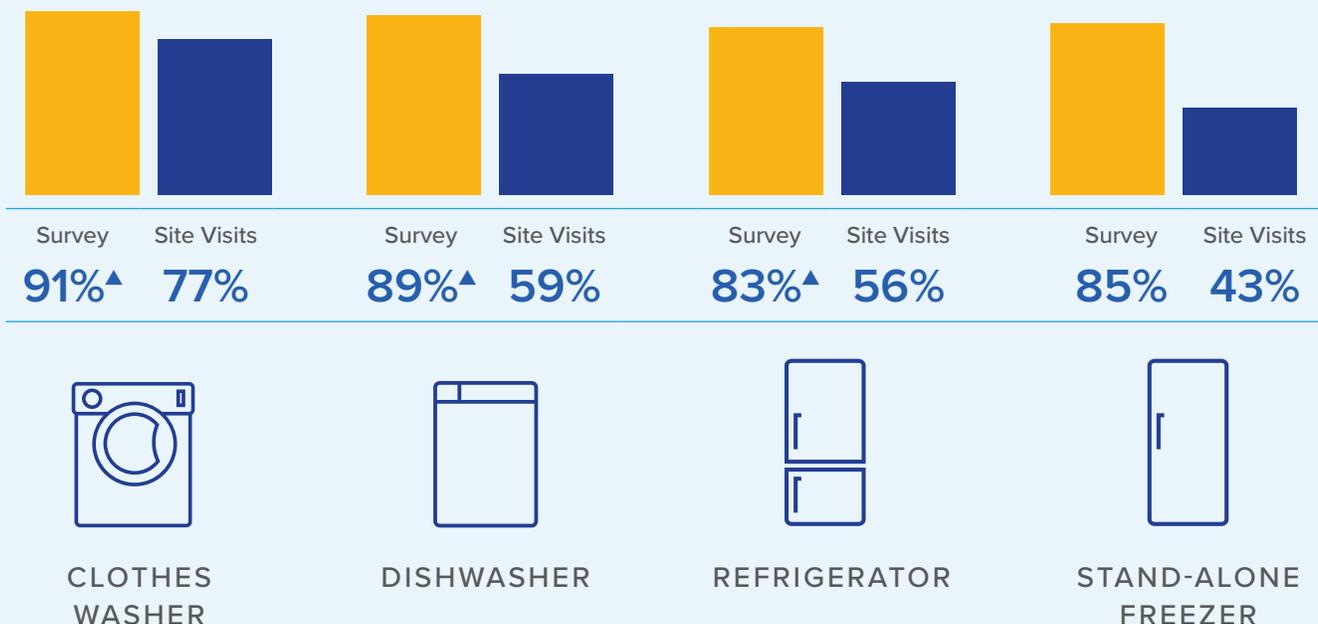
Survey data show a **significant shift in clothes dryer fuel** from electricity and propane to natural gas.

	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6	
 Electricity	41%▼	59%▼	78%	54%▼
 Natural Gas	58%▲	37%▲	14%	43%▲
 Propane	1%▼	3%	8%	3%▼

SEE THE DATA

## PERCENTAGE OF ENERGY STAR APPLIANCE

For appliances less than 10 years old, surveys reported a **higher percentage as ENERGY STAR** than did site visits.



SEE THE DATA



# SECTION 7

## ELECTRONICS

Few aspects of homes have changed as dramatically as household electronics in recent years, thanks to transformational forces such as the internet and smart phones and the rapid adoption of flat-screen televisions. The RBSA used mostly the same survey questions and site visit procedures as the 2015 RSBS to collect data on household electronics and related plug loads, to ensure that at least most results could be directly compared.

The RBSA relied mostly on site visits to collect information about televisions. During site visits, field technicians characterized each television, including

the type and size. Field staff also collected information about a variety of other electronics in each home, including counts of popular electronic components and office equipment.

Several results reported in this section draw on survey responses regarding the quantity and sometimes usage of various electronic components, from the number of cell phones used by household members to how many hours per day residents use desktop and laptop computers.

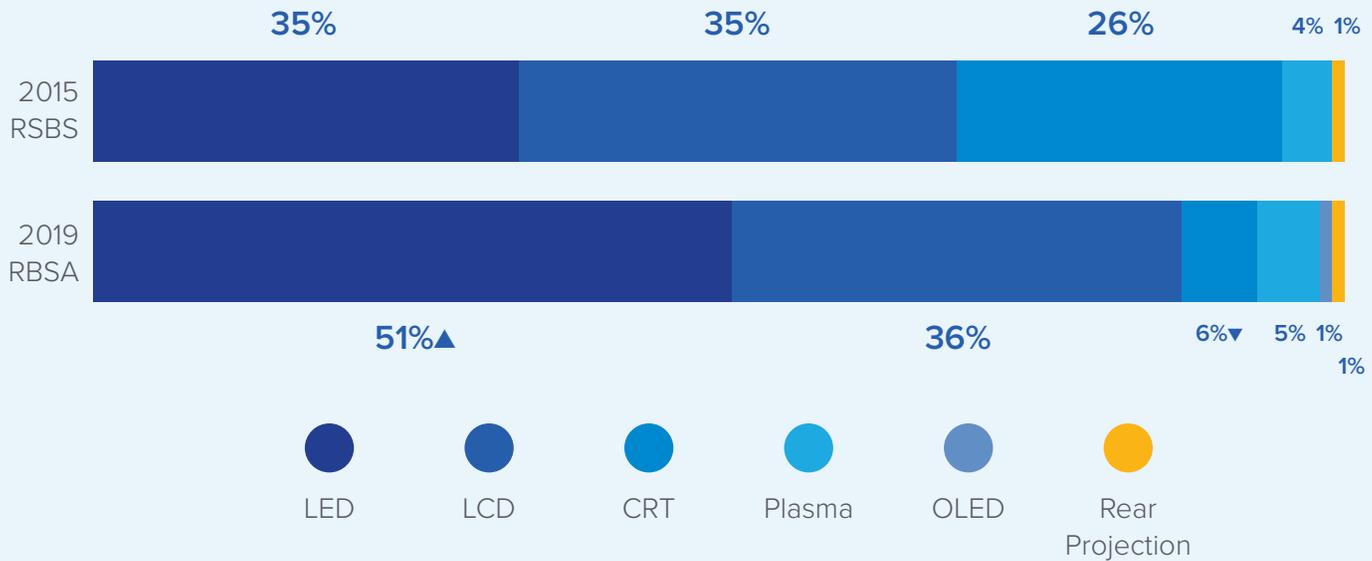
## TELEVISION TECHNOLOGY

When characterizing televisions, it helps to be clear about the difference between liquid-crystal display (LCD) and LED televisions. Even with televisions marketed as LED, an LCD panel provides the pixels that make up the image, and a light source is required to bring the images to life.

The type of lighting determines whether the television is considered an LED television. With an LED television (really an LCD television with LED lighting), the television uses LEDs behind the

LCD panel (or along the edges) rather than cold cathode fluorescent lamps (CCFLs). CCFL lighting is found mostly in older, thicker flat-screen televisions. Organic LED (OLED) technology promises better display quality, thinner screens, and lower energy usage by providing LEDs small enough to provide both the pixels and the light, doing away with the LCD panel.

LED and LCD televisions dominate with a **combined share of 87%** based on site visit data.



SEE THE DATA

## KEY FINDINGS

### LED LEADS THE WAY

LED televisions now make up more than half of all televisions statewide, according to site visit data, and LED and LCD televisions combined account for nearly 90%. CRT televisions show a sharp decline, at 6%, while OLED televisions have begun to appear.

### TELEVISIONS GROW LARGER

Installed LED and LCD televisions screens are larger on average than reported in the 2015 RSBS, bringing the statewide average up significantly to 39 inches (compared with 33 inches in the previous study). CRT, plasma, and rear projection televisions remain about the same size.

### SIGNS OF STREAMING

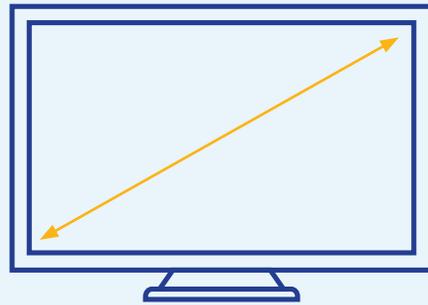
Survey participants reported significantly fewer traditional electronic components such as DVD players, VCRs, and stereo systems than in the 2015 RSBS. The numbers were not dramatically lower but likely illustrate the trends toward streaming video content and listening to music through phones.

### MORE COMPUTERS USED LESS

Not surprisingly given the proliferation of smart phones, reported computer usage has declined significantly since the 2015 RSBS, down by more than 15%. That said, survey participants also reported having significantly more desktop and laptop computers in their household.

## TELEVISION SCREEN SIZE BY TECHNOLOGY

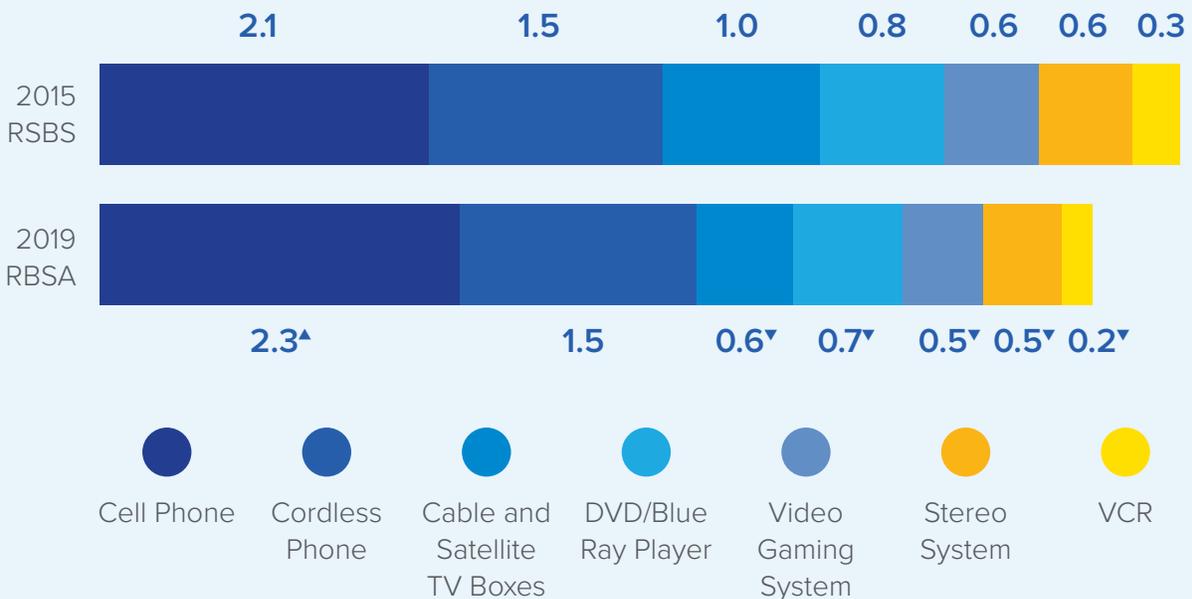
Average LED and LCD screen sizes have **grown significantly larger**.



	LED	LCD	CRT	PLASMA	REAR PROJECTION	OVERALL
2015 RSBS	38"	34"	24"	45"	62"	33"
2019 RBSA	42" <sup>▲</sup>	37" <sup>▲</sup>	24"	42"	65"	39" <sup>▲</sup>

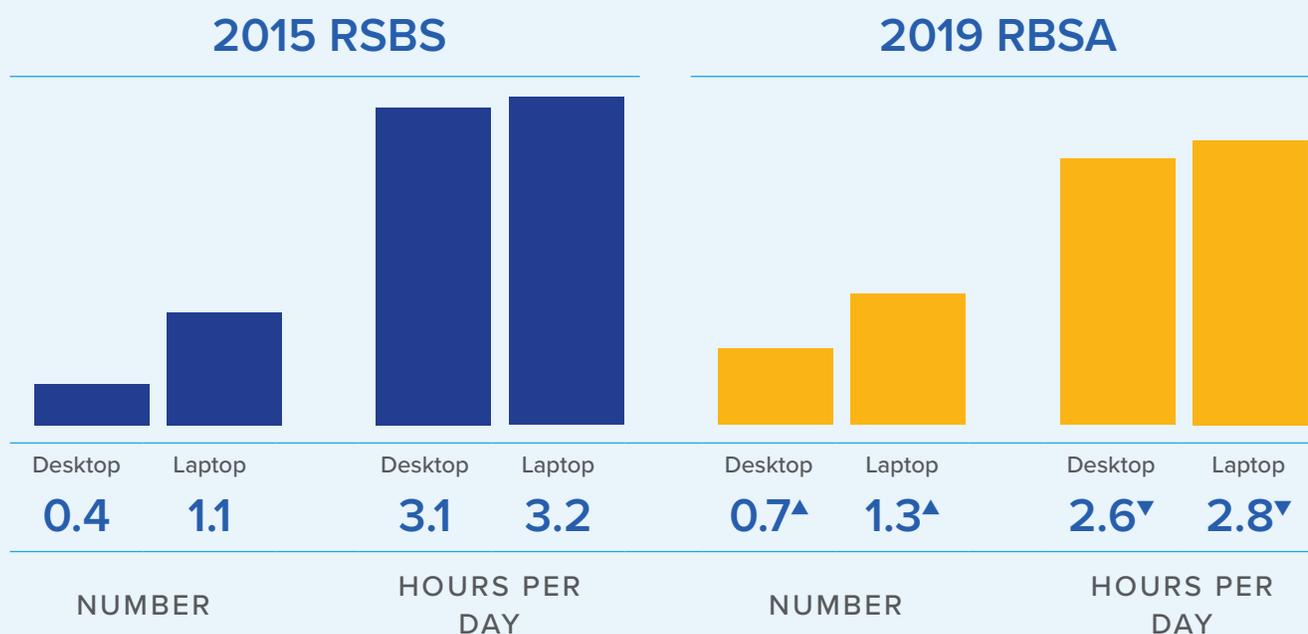
## AVERAGE NUMBER OF ELECTRONICS COMPONENTS PER HOME BY STUDY

Electronic plug load equipment saw **both an increase and decrease** in the number of devices per home.



NUMBER AND HOURS OF USE OF DESKTOP AND LAPTOP COMPUTERS

Survey participants reporting **owning more computers** than in the 2015 RSBS but using them fewer hours per day.



SEE THE DATA

SMART STRIP USAGE AND TYPE BY STUDY

The use of **smart strips remains low**, based on survey data.

		2015 RSBS	2019 RBSA
Use Smart Strip	Yes	14%	13%
	No	86%	87%
Type of Smart Strip	Tier 1 smart strip <sup>a</sup>	85%	79%
	Tier 2 smart strip <sup>b</sup>	7%	10%
	Tier 1 and Tier 2	8%	11%

<sup>a</sup>Tier 1 smart strips turn off when the computer is powered off or goes to sleep.

<sup>b</sup>Tier 2 smart strips turn off when you leave or at a programmed time.

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# SECTION 8

## CONNECTED DEVICES

Data collection of connected devices is new for the 2019 RBSA and comprised survey questions and site visit tasks. Survey questions first asked participants if any equipment in the home could be controlled remotely and then asked them to identify specific types of equipment from a list. During site visits, field technicians identified whether the home included any of eight types of connected equipment. Results varied somewhat for connected equipment collected with the two methods, which may result from self-selection bias and/or from survey participant and field technician error.

RBSA data collection observed the distinction between connected and smart devices: A connected device can be controlled remotely, whereas a smart device can use learned or detected information to automatically alter operation or provide suggestions, such as modifying the temperature setpoint of a heating or cooling system based on learned usage patterns in the case of a smart thermostat. All smart devices are likely connected, but not all connected devices are smart.

## KEY FINDINGS

### CONNECTED DEVICES GAIN TRACTION

Almost one-quarter (24%) of homes statewide have at least one device that can be controlled remotely, according to survey responses. These devices span a wide range, from thermostats and lighting to major appliances and pool pumps.

### THERMOSTATS GET CONNECTED

Survey responses show that 16% of single-family households with a central heating and/or cooling system statewide use a connected thermostat.

### DIGITAL ASSISTANTS STAND OUT

Based on site visit data (not shown here), the most prevalent connected device is the digital assistant—smart speakers that use services such as Amazon Alexa, Apple Siri, or Google Assistant to respond to natural language questions and requests. Weighted results estimate that 29% of homes statewide have such a device, which can also control compatible home automation components. In survey results, which focused more on equipment that can be controlled remotely, connected thermostats were by far the most prevalent.

## CONNECTED AND SMART THERMOSTATS

Of homes with central heating and/or cooling, **16% statewide** have a **connected thermostat** according to survey data.



\*Includes smart thermostats

## CONNECTED HOMES WITH EACH TYPE OF CONNECTED DEVICE

Percentages show the **proportion of homes with each type of device** for homes with at least one connected device.

	CLIMATE ZONE 4	CLIMATE ZONE 5	CLIMATE ZONE 6	STATEWIDE
Have at Least One Device	31%	20%	13%	24%
Type of Device in Homes with at Least One Device				
Thermostat	54%	51%	34%	52%
Security	39%	32%	36%	37%
Lights	32%	35%	40%	33%
Other	16%	20%	31%	19%
Pool Pump	2%	1%	0%	2%
Major Appliance(s)	1%	3%	5%	2%
Whole House Humidifying	1%	2%	0%	1%
Water Heating Equipment	1%	1%	2%	1%

SEE THE DATA

SEE THE DATA



# SECTION 9

## ENERGY EFFICIENCY PROGRAM AWARENESS AND PARTICIPATION

The 2019 RBSA web and telephone survey used similar questions related to energy efficiency programs as the 2015 RSBS, both to collect information about current participation and to note changes relative to the previous study. The survey asked three questions:

- In the past five years, has your household participated in any energy efficiency or energy saving programs offered by NYSERDA or your utility company to make your home or appliances more energy efficient?

- What type of equipment did you install or recycle through a program?
- What do you think are the challenges with participating in energy efficiency programs?

Only the third question differed from its 2015 version, which asked “Why hasn’t your household participated in any energy efficiency programs?” Other survey questions asked about willingness to replace equipment in the next five years and the perception of the level of energy efficiency of the participants’ homes.

## KEY FINDINGS

### PARTICIPATION REMAINED THE SAME

Compared with the 12.2% who reported participating in an energy efficiency program in the 2015 RSBS, the 10.5% reported in the 2019 RBSA was lower but not statistically different.

### AC PARTICIPATION INCREASED

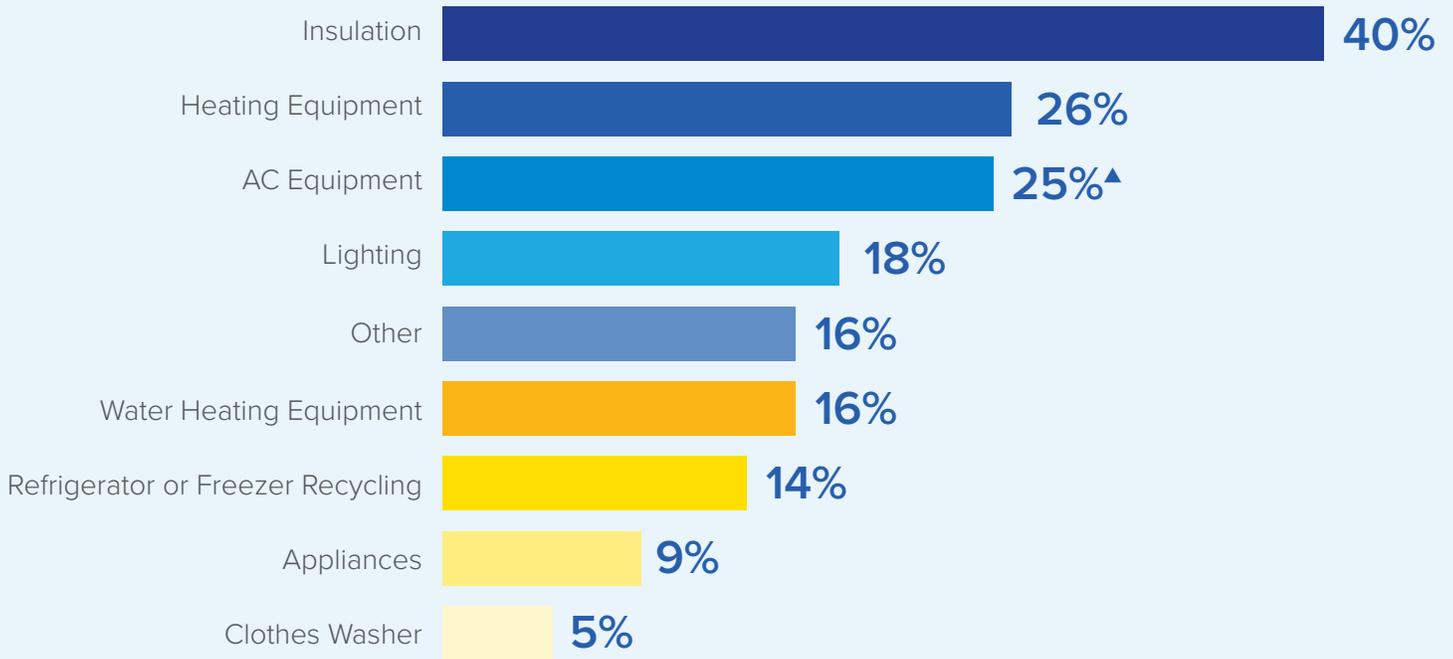
Of respondents who reported participating in energy efficiency rebate or recycling programs, 25% reported participating in an air conditioning rebate or recycling program—up from 14% in the 2015 RSBS.

### KNOWLEDGE REMAINS KEY

As with the 2015 RSBS, more than 50% of survey respondents who did not participate in an energy efficiency program reported that they did not know of any programs. Compared with 2015 respondents, twice the percentage (30%) reported in the current study that they did not know who to contact. The percentage of respondents who reported not being able to afford installing new equipment (29%) also increased significantly from 19% in 2015.

REPORTED PROGRAM PARTICIPATION

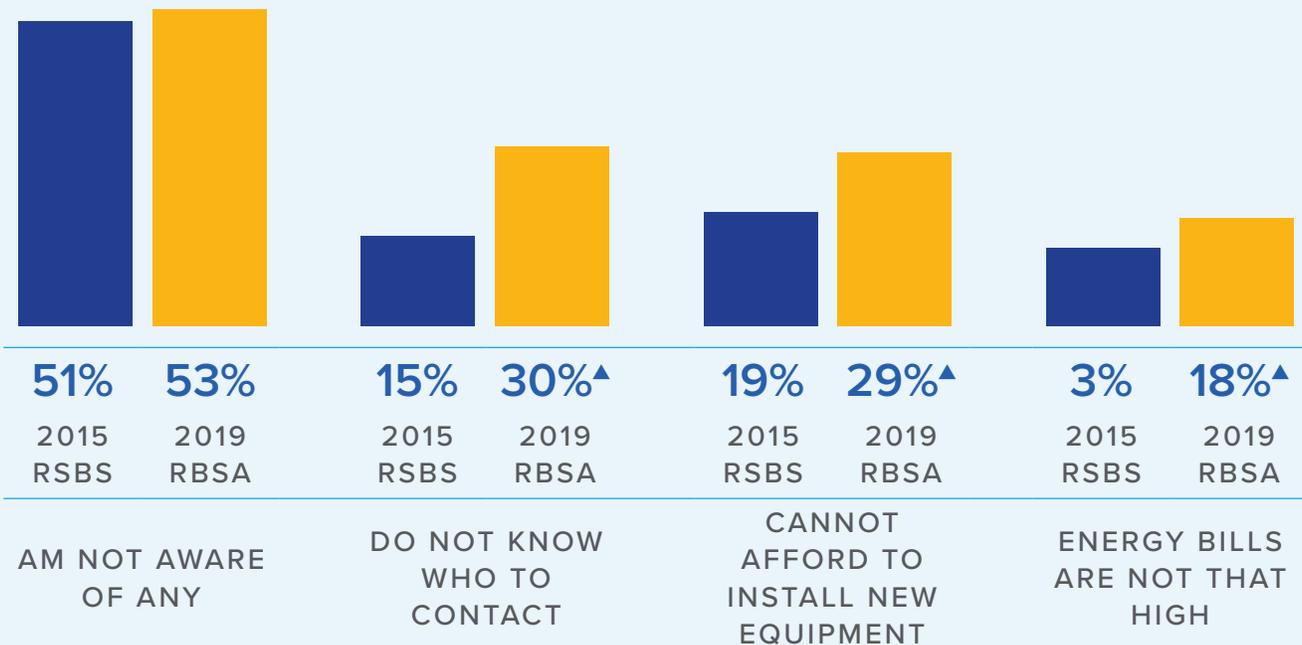
The table shows program participation for the **10.5% of survey respondents** who reported participating in an energy efficiency program.



SEE THE DATA

TOP REASONS FOR NOT PARTICIPATING IN ENERGY EFFICIENCY PROGRAMS

Significantly more people reported **not knowing who to contact** than in the 2015 RSBS.



SEE THE DATA